

Environmental Scan Report

Barwon South West Region

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1. Introduction

Planning by agencies has traditionally focused on each hazard type e.g. fire, flood or storm, using risk-based decision-making processes to inform preparedness, response, relief and recovery (PPRR) activities. Victorian emergency management arrangements also support agencies and relevant stakeholders to work together across all hazard types. This includes creating opportunities to identify and manage priorities to effectively manage risks, together with communities and organisations from within and outside the emergency management sector.

In 2020, the *Emergency Management Act 2013* was updated by the *Emergency Management Legislation Amendment Act 2018*. In response to this, new State, Regional and Municipal plans are required to comply with the new legislation. Some of the key inclusions are information on regional context, and mitigation, response and recovery strategies, along with supporting roles and responsibilities for regional collaboration. The new arrangements also require the establishment of regional emergency management planning committees (REMPCs) and the preparation of regional emergency management plans (REMPs).

Emergency Management Victoria (EMV) is providing guidance to the REMPCs for each of the eight emergency management regions in Victoria to assist with the development of updated regional plans.

2. Purpose

The aim of this is to produce a document containing consistent, accurate contextual data and information for each REMPCs to use as a resource when preparing the context section of the REMPs.

The outputs from this analysis will link directly to the context section of the regional emergency management plans. The standard headings from the State plan reference natural, built, economic and social environments for consideration. While the relative importance of each of these will vary between regions, they will still provide a good overview of the key regional context.

3. Structure of document

The structure of this document first summarises the process used to investigate the environment under which each region operates. This environmental scanning process was undertaken using a PESTEL analysis (Political, Economic, Social, Technological, Environmental and Legal). The content of the document then explores the data and information found, grouped under the standard headings from the State Emergency Management Plan, Natural, Built, Social and Economic environments. Each of these has sub-headings relevant to the region. Finally, a data source section shows the data and information attribution and summarises the metadata for each source used in the document. This gives context to the data and information as well as an assessment of reliability, credibility and currency of the data.

4. Environmental scan process

The format for this analysis is a PESTEL analysis (Political, Economic, Social, Technological, Environmental and Legal). These categories are often used for business analysis to cover all aspects of context for a project or business proposal to expand the thinking outside of the standard considerations. This will broaden the scope of the emergency management sector to cover all emergencies and all communities. Further detail for each key area is provided in the image below.

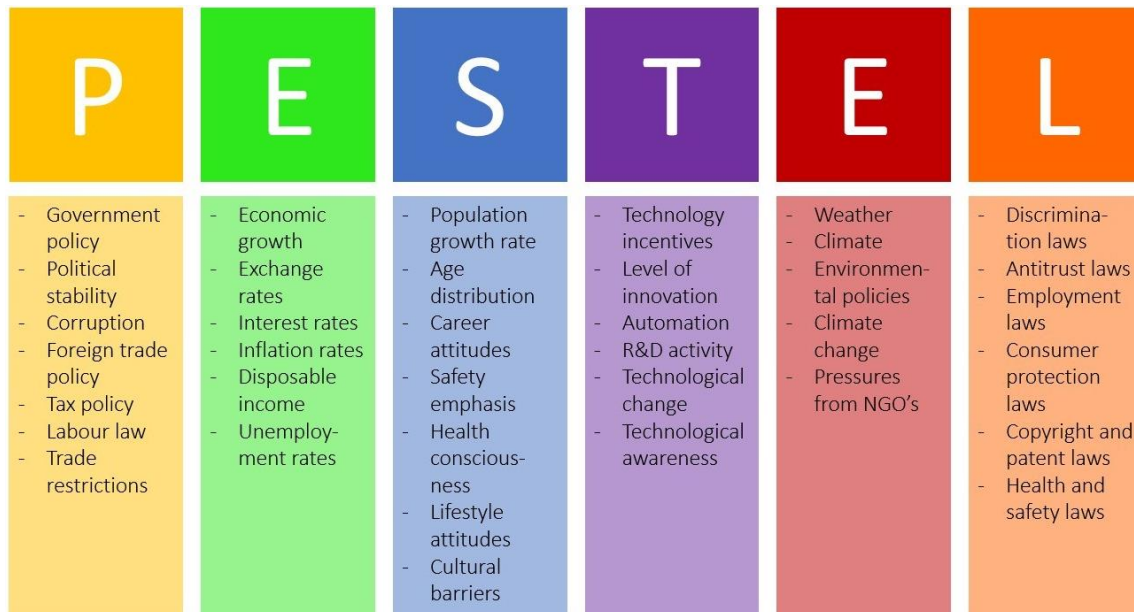


Figure 1. PESTEL analysis¹

The broad environmental scanning process ensured that all impacts on the region were considered, including those influences outside of the regional boundaries.

5. Regional Context

The Barwon South West Region includes the traditional lands of the Gunditjamarra, Eastern Maar and Wadawurrung peoples², and is one of eight regions for emergency management in Victoria, declared under Section 63 of the *Emergency Management Act 2013*.

¹ B2U (2020): <https://www.business-to-you.com/scanning-the-environment-pestel-analysis/>
² ACHRIS (2020): <https://achris.vic.gov.au/weave/wca.html>

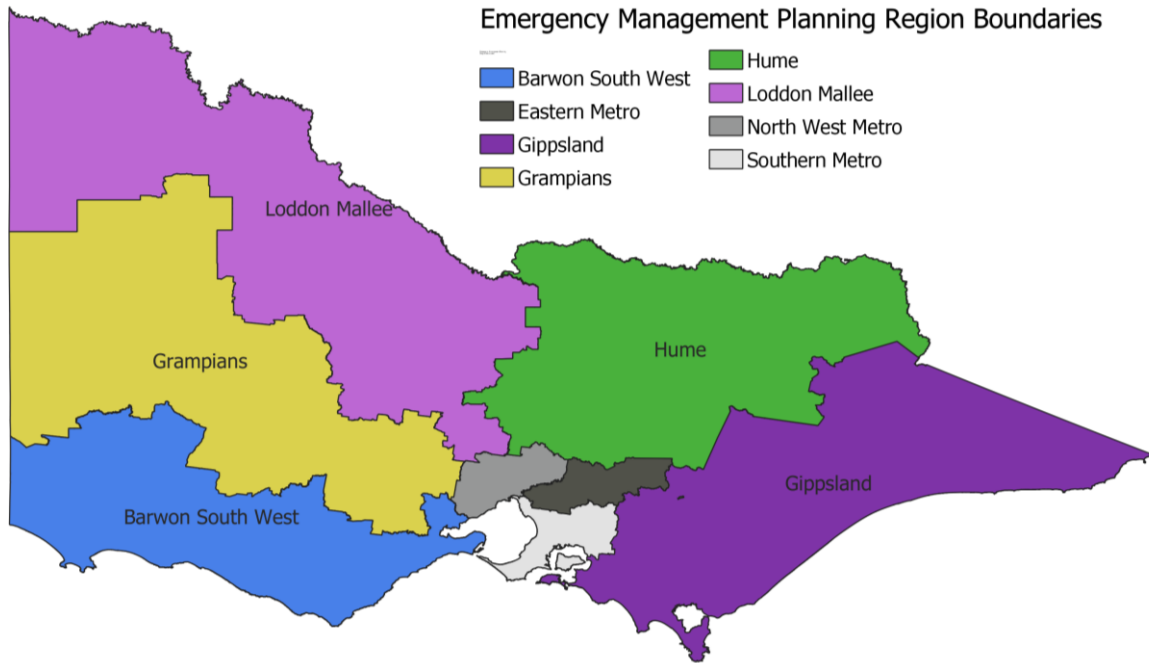


Figure 2. Victorian Emergency Management Regions

The Barwon South West Region shares boundaries with the Grampians and North and West Metropolitan Regions. It covers 29,130 square kilometres (13% of Victoria) and includes 9 local government areas (LGAs).



Figure 3. Barwon South West Region including LGA boundaries³

³ DJPR (2020): <https://www.rdv.vic.gov.au/victorias-regions/barwon-south-west>

The LGAs located within the Barwon South West Region, and their corresponding populations (2019) are:

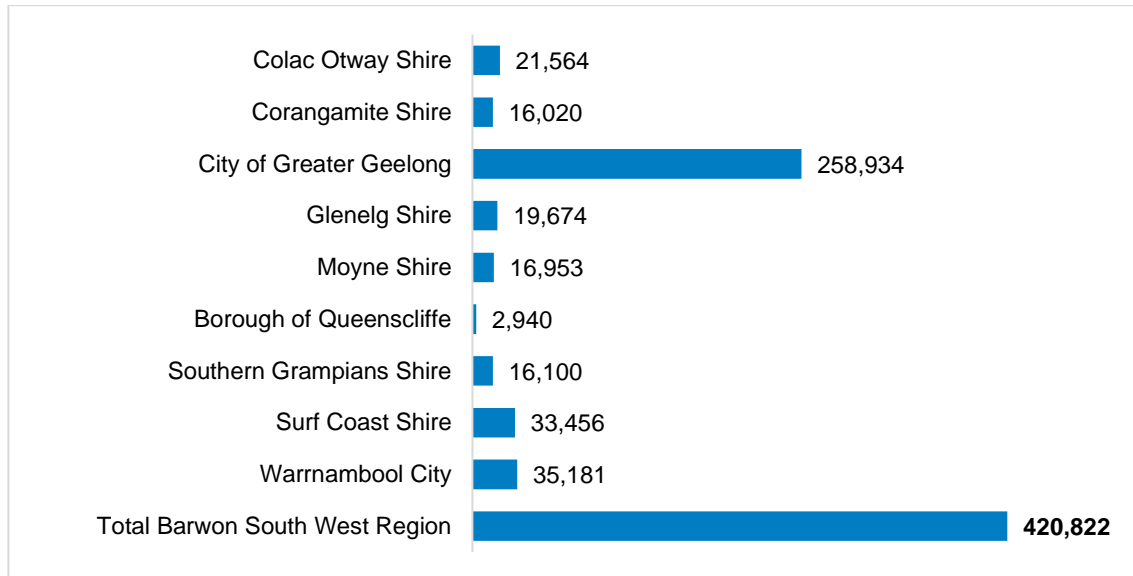


Figure 4. Barwon South West Region LGA population breakdown (2019)⁴

The Barwon South West Region extends from the tip of Queenscliff to the border of South Australia and is home to Victoria’s largest regional city – Geelong.⁵ It incorporates two sub-regions – Barwon and the Great South Coast.

It is one of the five regions which borders metropolitan Melbourne, with the areas in the east (the Barwon sub-region) falling within Melbourne’s peri-urban fringe. As a result, these areas experience elevated population and development pressures on landscapes, agricultural, waterway and environmental assets. For the areas falling in the western part of the region (the Great South Coast sub-region) there are fewer development pressures, with more rural landscapes and smaller towns.

Barwon sub-region

The Barwon sub-region includes the LGAs of Colac Otway Shire, Greater Geelong, the Borough of Queenscliffe and Surf Coast Shire. Its main regional centre is Geelong (Victoria’s second largest city), which provides key services and employment activity for the whole region. Other regional centres include Lara, Ocean Grove, Torquay and Colac.

The Barwon sub-region is home to a number of tourism assets and events, such as the Great Ocean Road and Bells Beach. Its economy is traditionally driven by agriculture, manufacturing, construction and tourism, with agriculture focused on sheep, beef and dairy, as well as broadacre cropping and horticulture.⁶

⁴ DJPR (2020): <https://www.rdv.vic.gov.au/information-portal/table-and-chart>

⁵ <https://www.rdv.vic.gov.au/victorias-regions/barwon-south-west>

⁶ <https://www.rdv.vic.gov.au/victorias-regions/barwon-south-west/barwon>

Great South Coast sub-region

The Great South Coast sub-region includes the LGAs of Corangamite Shire, Glenelg Shire, Moyne Shire, Southern Grampians Shire and Warrnambool City. Its main regional centre is Warrnambool, with other regional centres including Portland and Hamilton.

The Great South Coast sub-region features strong tourism, agricultural and fishing industries, with a deep-water port located at Portland, an established rail network and several commercial airports. Similar to the Barwon sub-region, the Great South Coast attracts significant numbers of tourists each year, with the Great Ocean Road and Shipwreck Coast representing popular attractions. The sub-region also provides a significant contribution to national agricultural production, with dairying across the south, significant forestry in the west and livestock and grains industries in the north.⁷



Figure 5. Barwon and Great South Coast sub-regions including LGA boundaries⁸

6. Natural Environment

The Barwon South West Region stretches over 300 kilometres from the South Australia border to Queenscliff Heads in the east, with the coastline representing important recreational and biodiversity value. The region also contains highly productive agricultural land, natural lakes, wetlands and waterways. Major rivers include the Hopkins, Glenelg and Barwon Rivers.⁹

The Barwon sub-region has many significant environmental features including the Great Ocean Road, Great Otway National Park and Port Phillip Heads Marine National Park.

⁷ https://www.planning.vic.gov.au/__data/assets/pdf_file/0031/94567/Great-South-Coast-Regional-Growth-Plan-May-2014.pdf

⁸ DJPR (2020); <https://www.rdv.vic.gov.au/victorias-regions/barwon-south-west>

⁹ DJPR (2014); https://www.planning.vic.gov.au/__data/assets/pdf_file/0031/94567/Great-South-Coast-Regional-Growth-Plan-May-2014.pdf

The Great South Coast sub-region also has notable coastal environmental assets, including part of the Grampians National Park, multiple national state parks and reserves, wetlands, the Twelve Apostles Marine National Park and the Budj Bim Cultural Landscape that was inscribed on to the World Heritage list in 2019.

6.1 Climate

6.1.1 Average Temperatures

The Barwon South West region has a temperate climate, with mild to warm summers and cold winters. Average maximum temperatures in summer are between 22° and 24° near the coast and in elevated areas, and 25° to 27° in inland areas.¹⁰ Winter average maximum temperatures are between 12 to 14°C.¹¹

Average maximum (max) and minimum (min) temperatures from a 30-year climate period from (1961-1990) are outlined below:

Table 1. Seasonal average temperatures for BSWR¹²

LGA	Summer (°C)		Winter (°C)	
	Max	Min	Max	Min
Colac Otway Shire	23.0	11.4	12.7	5.3
Corangamite Shire	24.2	11.7	13.2	5.2
Glenelg Shire	24.1	11.5	13.6	5.5
Greater Geelong	24.5	13.2	14.0	5.7
Moyne Shire	23.8	11.9	13.5	5.5
Queenscliffe Borough	23.6	14.0	14.1	6.9
Southern Grampians Shire	25.7	10.8	12.6	4.1
Surf Coast Shire	23.6	12.3	13.1	6.1
Warrnambool City	23.0	12.8	14.4	6.5
BSWR Average	23.9	12.2	13.5	5.6

6.1.2 Rainfall

Rainfall in the Barwon South West Region occurs predominantly in winter and spring and is generally the result of rain-bearing weather systems from the west.¹³ Most Shires around the region receive between 600–700 mm of rain per year. The highest rainfall occurs in the Colac Otway Shire at just below 900mm annually, while Geelong records just above 450mm per year.¹⁴ Since the 1950s, average rainfall has declined, especially in Autumn.

¹⁰ DELWP (2015): https://www.climatechange.vic.gov.au/__data/assets/pdf_file/0020/60743/Barwon-South-West.pdf

¹¹ DELWP (2015): https://www.climatechange.vic.gov.au/__data/assets/pdf_file/0020/60743/Barwon-South-West.pdf

¹² BOM (2020): <http://www.bom.gov.au/climate/averages/maps.shtml>

¹³ DELWP (2015): https://www.climatechange.vic.gov.au/__data/assets/pdf_file/0020/60743/Barwon-South-West.pdf

¹⁴ DELWP (2015): https://www.climatechange.vic.gov.au/__data/assets/pdf_file/0020/60743/Barwon-South-West.pdf

Table 2. Annual and seasonal average rainfalls (mm) for BSWR by LGA¹⁵

LGA	Mean Rainfall (mm)				
	Annual	Summer	Autumn	Winter	Spring
Colac Otway Shire	954.6	150.9	228.4	314.8	260.4
Corangamite Shire	729.8	121.3	174.6	233.6	200.4
Glenelg Shire	725.1	95.8	162.0	270.9	196.4
Greater Geelong	557.8	123.2	134.0	142.0	158.6
Moyne Shire	716.9	113.2	168.5	237.6	197.7
Queenscliffe Borough	619.4	124.7	154.4	174.4	165.9
Southern Grampians Shire	627.0	125.9	156.8	176.5	167.7
Surf Coast Shire	662.7	100.5	149.9	224.8	187.6
Warrnambool City	734.7	130.6	176.2	221.1	206.8
BSWR Average	712.3	120.7	169.4	227.2	195.0

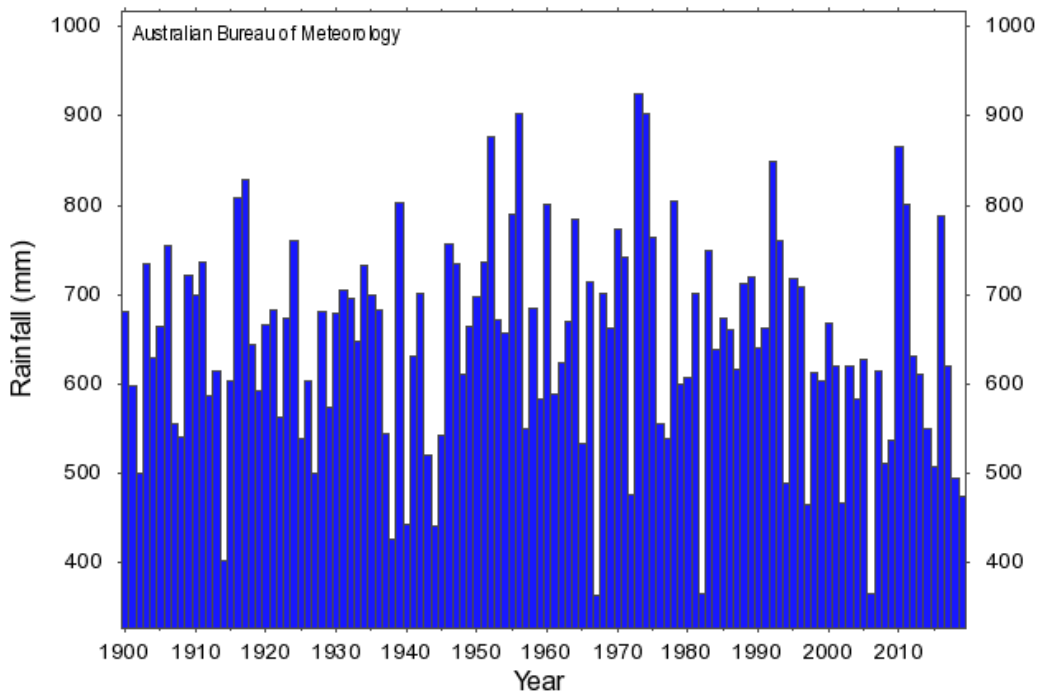


Figure 6. Annual rainfall Victoria (1900-2019)¹⁶

Intensity–Frequency–Duration (IFD) design rainfall intensities (mm/h) or design rainfall depths (mm) corresponding to selected standard probabilities, are based on the statistical analysis of historical rainfall. Design rainfall are used in the design of infrastructure including gutters, roofs, culverts, stormwater

¹⁵ BOM (2020): <http://www.bom.gov.au/climate/averages/maps.shtml>

¹⁶ BOM(2020)

http://www.bom.gov.au/climate/change/index.shtml#tabs=Trackerandtracker=timeseriesandtQ=graph%3Drain%26area%3Dvic%26season%3D012%26ave_yr%3D0

drains, flood mitigation levees, retarding basins and dams. They can also be used to assess the severity of observed rainfall events.

The following tables summarise the design rainfalls that could be of interest for critical infrastructure planning. They give an indication of heavy rainfall probability across the region and can be used as potential triggers for response based on observed or forecast rainfall.¹⁷ The standard probabilities shown here for reference are 10% annual exceedance probability (AEP) equivalent to 1 in 10 year average recurrence interval (ARI), and 1% AEP, equivalent to 1 in 100 year ARI.

Table 3. BSWR Design rainfalls 5 min by LGA^{18 19}

LGA	5 min 10% AEP (mm)				5 min 1% AEP (mm)			
	Mean	Min	Max	Range	Mean	Min	Max	Range
Colac Otway Shire	7.3	6.6	9.1	2.5	11.5	10.4	13.9	3.5
Corangamite Shire	7.4	6.7	8.3	1.6	11.9	10.7	14.0	3.3
Glenelg Shire	7.8	7.3	8.4	1.1	12.9	12.0	13.9	2.0
Greater Geelong	7.4	7.1	8.1	1.0	12.2	11.7	13.4	1.8
Moyne Shire	8.6	7.0	9.5	2.6	14.7	10.8	16.8	6.0
Queenscliffe Borough	7.7	7.7	7.8	0.2	12.1	12.0	12.2	0.2
Southern Grampians Shire	8.4	7.8	9.9	2.1	14.1	13.0	16.6	3.5
Surf Coast Shire	7.1	6.7	8.9	2.2	11.6	10.8	13.7	2.9
Warrnambool City	8.3	7.9	8.5	0.6	14.1	13.3	14.6	1.4

Table 4. BSWR Design rainfalls 1hr by LGA^{20 21}

LGA	1hr 10% AEP (mm)				1hr 1% AEP (mm)			
	Mean	Min	Max	Range	Mean	Min	Max	Range
Colac Otway Shire	22.2	19.8	28.5	8.8	34.9	30.9	44.0	13.1
Corangamite Shire	22.2	20.1	24.9	4.8	35.7	31.8	41.8	10.0
Glenelg Shire	23.3	21.7	24.8	3.1	38.4	35.6	41.8	6.2
Greater Geelong	22.5	21.5	24.7	3.2	37.2	35.5	40.6	5.1
Moyne Shire	25.6	20.9	28.2	7.3	43.8	32.8	49.9	17.1
Queenscliffe Borough	23.4	23.2	23.8	0.5	36.6	36.3	37.0	0.7
Southern Grampians Shire	25.0	23.2	29.5	6.2	42.2	38.8	49.6	10.8
Surf Coast Shire	21.7	20.4	27.9	7.4	35.1	32.9	43.2	10.3
Warrnambool City	24.4	23.4	25.0	1.6	41.6	39.4	43.2	3.8

¹⁷ Further values can be obtained from: <http://www.bom.gov.au/water/designRainfalls/revised-afd/>

¹⁸ BOM (2016): <http://www.bom.gov.au/water/designRainfalls/revised-afd/>

¹⁹ The standard probabilities shown here for reference are 10% annual exceedance probability (AEP) equivalent to 1 in 10 year average recurrence interval (ARI) and 1% AEP, equivalent to 1 in 100 year ARI

²⁰ BOM (2016): <http://www.bom.gov.au/water/designRainfalls/revised-afd/>

²¹ The standard probabilities shown here for reference are 10% annual exceedance probability (AEP) equivalent to 1 in 10 year average recurrence interval (ARI) and 1% AEP, equivalent to 1 in 100 year ARI

Table 5. BSWR Design rainfalls 1 Day by LGA^{22 23}

LGA	1 day 10% AEP (mm)				1 day 1% AEP (mm)			
	Mean	Min	Max	Range	Mean	Min	Max	Range
Colac Otway Shire	86.4	62.5	154.0	91.5	140.6	98.9	257.1	158.3
Corangamite Shire	70.3	62.2	85.5	23.3	115.8	99.9	141.4	41.5
Glenelg Shire	68.5	62.5	74.8	12.3	118.8	107.4	132.2	24.8
Greater Geelong	71.9	67.2	87.0	19.8	115.1	106.5	140.4	33.9
Moyne Shire	70.9	66.9	74.9	8.0	122.2	111.6	133.1	21.5
Queenscliffe Borough	70.9	70.7	71.5	0.8	113.7	113.3	114.7	1.5
Southern Grampians Shire	70.0	64.5	99.5	35.0	119.1	110.3	160.4	50.1
Surf Coast Shire	82.2	64.5	149.3	84.8	132.7	101.8	248.3	146.5
Warrnambool City	68.1	66.8	69.2	2.3	120.6	118.1	122.2	4.1

For the Barwon South West Region, there is some variation in the shorter duration events which are generally driven by convective activity. Statistical analysis shows that that patterns of heavy rainfall from these storm events are similar across the region. This is shown by similar mean design rainfall values across all LGAs and low ranges between maximums and minimums for the selected probabilities.

The largest difference is observed in the longer duration events, where orographic enhancement from larger synoptic systems generally leads to higher rainfall in elevated areas based on the prevailing wind direction, in this case, the regions with variable topography Colac-Otway and Surf Coast.

It is expected that the impact of climate change will be less days with rain, but higher intensity rain events when those do happen. This is because a warmer atmosphere can hold more moisture. Australia's heavy rainfall patterns have a high natural variability and some sites are witnessing a larger increase in heavy rainfall for shorter duration events that may increase the risk of flash flooding.²⁴

For the Barwon South West Region, despite an overall trend of declining rainfall, it is expected that more of the rain which does fall will be in increasingly extreme downpours, elevating the risk of flood events.²⁵

Rain Days >5mm by LGA

This rainfall calculation is based on the standard 30-year reference climate period (1961–1990). This threshold was chosen because 5mm is the threshold to exceed canopy and interception losses in the Keetch-Byram Drought Index, which is used to estimate soil moisture as a surrogate for heavy fuel

22 BOM (2016): <http://www.bom.gov.au/water/designRainfalls/revise-ifd/>

23 The standard probabilities shown here for reference are 10% annual exceedance probability (AEP) equivalent to 1 in 10 year average recurrence interval (ARI) and 1% AEP, equivalent to 1 in 100 year ARI

24 BOM (2020): <http://www.bom.gov.au/state-of-the-climate/australias-changing-climate.shtml>

25 DELWP (2015): https://www.climatechange.vic.gov.au/__data/assets/pdf_file/0020/60743/Barwon-South-West.pdf

availability in fires. The high range between the maximum and minimum number of rain days highlights the rainfall variability across the region with the drier areas to the west and wetter areas in the elevated areas.

26

Table 6. BSWR Rain Days >5mm by LGA^{27 28}

LGA	Rain Days >5mm (days)			
	Mean	Min	Max	Range
Colac Otway Shire	60	39	91	52
Corangamite Shire	48	36	71	35
Glenelg Shire	48	41	56	15
Greater Geelong	33	28	40	12
Moyne Shire	47	38	57	19
Queenscliffe Borough	40	40	41	1
Southern Grampians Shire	44	38	60	22
Surf Coast Shire	46	39	70	31
Warrnambool City	51	49	54	5
BSWR Average	46.3	38.7	60.0	21.3

6.1.3 Climate Change

The Barwon South West Region has been getting warmer and dryer, with the rate of warming increasing since 1960 and rainfall declining. In the future, the region can expect:²⁹

- Temperatures to continue to increase year-round;
- More frequent and intense downpours;
- Less rainfall in winter and spring;
- More hot days and warmer spells, and fewer frosts;
- Harsher fire weather and longer fire seasons;
- Increased frequency and height of extreme sea level events; and
- Rising sea level.

26 BOM (2016): http://www.bom.gov.au/jsp/ncc/climate_averages/raindays/index.jsp?period=anandproduct=5mm#maps

27 This calculation is based on the standard 30 year reference climate period (1961 – 1990). The threshold chosen as 5mm is the threshold to exceed canopy and interception losses in the Keetch-Byram Drought Index, which is used to estimate soil moisture as a surrogate for heavy fuel availability in fires.

28 BOM (2016): http://www.bom.gov.au/jsp/ncc/climate_averages/raindays/index.jsp?period=anandproduct=5mm#maps

29 DELWP (2015): https://www.climatechange.vic.gov.au/__data/assets/pdf_file/0020/60743/Barwon-South-West.pdf

By 2050, as a result of these changes, the climates of Hamilton and Colac are expected to be more like the climate of Melbourne currently, while the climate of Warrnambool will be more like the current climate of Lakes Entrance.³⁰



Figure 7. Barwon South West Region Climate in 2050³¹

The potential impacts of these changes in climate impacts all aspects of the natural, built, social and economic aspects of the region, including primary production, infrastructure, tourism, health and community and the natural environment, as outlined below:³²

Primary production

The impacts on primary production are likely to be acutely felt in the Barwon South West Region, with two of the region’s largest industries – agriculture (dairy, beef and sheep grazing, broadacre cropping and viticulture) and forestry, being sensitive to the impacts of climate change. Agriculture, especially dairy is sensitive to a reduction in water supply and higher temperatures, while forestry is adversely impacted by warmer and drier conditions, as well as harsher fire weather.

Infrastructure

Rising sea levels threaten coastal infrastructure, houses and beaches, with flow-on effects to transport, tourism and the natural environment. Extreme weather events will threaten critical infrastructure and increase maintenance costs, with critical services such as power, water, sewerage and telecommunications being susceptible to extreme weather.

30 DELWP (2015): https://www.climatechange.vic.gov.au/__data/assets/pdf_file/0020/60743/Barwon-South-West.pdf
 31 DELWP (2015): https://www.climatechange.vic.gov.au/__data/assets/pdf_file/0020/60743/Barwon-South-West.pdf
 32 DELWP (2015): https://www.climatechange.vic.gov.au/__data/assets/pdf_file/0020/60743/Barwon-South-West.pdf

Health and community

An ageing population, as well as areas of social disadvantage, will increase the number of people who may need assistance to manage extreme heat, bushfires and flooding, which will increase pressure on health and community services.

Tourism

Rises in sea level and coastal erosion will threaten tourism infrastructure such as low-lying roads, caravan parks and surf life-saving clubs, while heavy rainfall can cause landslips on access roads to popular tourist areas. Such events can threaten the community, visitor safety, tourism and damage popular environmental sites.

Environment

The coasts of the Barwon South West Region are highly sensitive to climate change impacts such as sea level rise, increased storm surge and coastal erosion. The region's diverse landscapes and natural systems will also be placed under an increased threat from sea level rise, changes in water availability, heat stress and extreme weather events.

6.2 Land Use

Land use in the Barwon South West Region is dominated by primary production at over 79% of total land area.

In the Barwon sub-region, most of the land is used for agriculture or parkland, while its extensive environmental assets are predominantly located in national parks and nature reserves. Agricultural uses are mainly dryland sheep grazing, beef and dairy and forestry plantations, while the region also supports broadacre cropping, horticulture and viticulture.³³

In the Great South Coast sub-region, environmental assets such as native forests, woodlands, grasslands and seasonal wetlands are also mainly located in national parks and reserves, while the remainder of the land is used for a mix of residential and other purposes.³⁴ The sub-region is also an important agricultural region with high value farmland and dairy production concentrated in the southern parts, while there are also extensive forestry plantations in the west.³⁵

Victoria's forestry and wood products industry is one of Australia's largest. Victoria's production accounts for 9 million cubic metres or 27.5% of Australia's log harvest volume.³⁶ It accounts for approximately \$7.3

³³ DELWP (2013): <http://www.dtpli.vic.gov.au/planning/plans-and-policies/rural-and-regional-planning/regional-growth-plans/g21-regional-growth-plan>

³⁴ DJPR (2014): https://www.planning.vic.gov.au/__data/assets/pdf_file/0031/94567/Great-South-Coast-Regional-Growth-Plan-May-2014.pdf

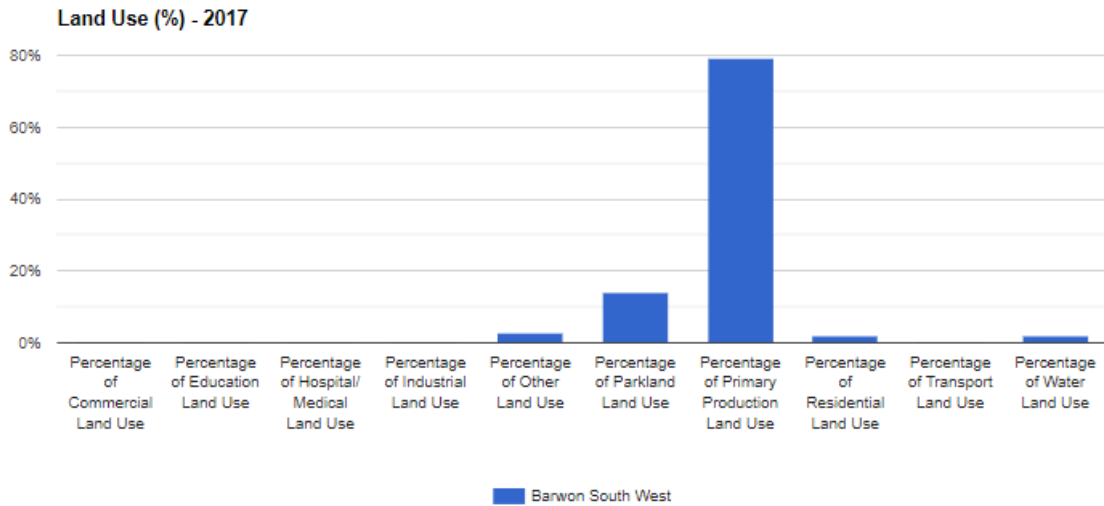
³⁵ DJPR (2014): https://www.planning.vic.gov.au/__data/assets/pdf_file/0031/94567/Great-South-Coast-Regional-Growth-Plan-May-2014.pdf

³⁶ DJPR (2020) <https://djpr.vic.gov.au/forestry>

billion or 31% of Australia’s forest product manufacturing sales and service income.^{37 38} Forestry is a key component of BSWR’s economic growth and a key driver of employment. BSWR is home to approximately 4,541 businesses in the agriculture, forestry and fishing industries, creating a total of 7,054 jobs for the region.³⁹

Table 7. Land usage by type across Barwon South West Region (2017)⁴⁰

Land Use Type	Area (Sq. Km)	% Area
Primary Production	23,051	79.1%
Parkland	4,128	14.2%
Other	749	2.6%
Water	591	2.0%
Residential	495	1.7%
Industrial	70	0.2%
Commercial	29	0.1%
Education	15	0.1%
Transport	3	0.0%
Hospital/Medical	0	0.0%
Total	29,130	100.0%



Source: RDV calculated using ABS Cat 1270.0.55.003, July 2017

Figure 8: Land use in BSWR (2017)

³⁷ DJPR (2020) https://djpr.vic.gov.au/_data/assets/pdf_file/0008/1924811/DJPR-Inclusion-Forestry-Plan-1.pdf

³⁸ DJPR (2020) <https://djpr.vic.gov.au/forestry>

³⁹ DJPR (2020): <https://www.rdv.vic.gov.au/information-portal/table-and-chart>

⁴⁰ DJPR (2020): <https://www.rdv.vic.gov.au/information-portal/table-and-chart>

Significant State and National parks located in the region are outlined below:

Table 8. Significant State and National Parks in BSWR⁴¹

LGA	State and National Parks
Colac Otway Shire	Great Otway National Park (part), Port Campbell National Park (part)
Corangamite Shire	Great Otway National Park (part), Port Campbell National Park (part), Twelve Apostles Marine National Park
Glenelg Shire	Budj Bim National Park (sections within Moyne Shire), Discovery Bay Coastal Park, Cobboboonee National Park, Lower Glenelg National Park, Mount Richmond National Park, Dergholm State Park, Cape Nelson State Park
Greater Geelong	Brisbane Ranges National Park, You Yangs Regional Park, Port Philip Heads National Park
Moyne Shire	Budj Bim National Park (sections within Glenelg Shire)
Queenscliffe Borough	
Southern Grampians Shire	Grampians National Park (part), Mount Napier State Park
Surf Coast Shire	Great Otway National Park (part)
Warrnambool City	

6.3 Bushfire Risk

Like the rest of Victoria, a large portion of the Barwon South West Region is prone to bushfires, particularly when grassland vegetation and forest litter becomes very dry.

In the Barwon sub-region, bushfires and grassfires are a natural feature and are an important part of the management of parks and forests, particularly in the Otway Ranges and surrounds.

In the Great South Coast sub-region, there are many high bushfire hazard areas which intersect with settlements and areas that are experiencing rural residential and tourism expansion.⁴² Some of the settlements identified for focused growth are also located in areas with bushfire hazards.

The Fire Danger Period (FDP) in Victoria has become longer over time, indicating a trend towards extended fire seasons. Seasonal fire restriction dates are set by municipality and depend on the amount of rain, grassland curing and other local conditions. The Fire Danger Period may be declared as early as October in some municipalities, and typically remains in place until the fire danger lessens, which could be as late as May.⁴³

⁴¹ <https://profile.id.com.au/>

⁴² DJPR (2014): https://www.planning.vic.gov.au/__data/assets/pdf_file/0031/94567/Great-South-Coast-Regional-Growth-Plan-May-2014.pdf

⁴³ CFA (2020) <https://www.cfa.vic.gov.au/warnings-restrictions/about-the-fire-danger-period#:~:text=The%20Fire%20Danger%20Period%20is,help%20prevent%20fires%20from%20starting.andtext=When%20is%20it%20declared%20%2D%20CFA,up%20to%20the%20fire%20season.>

Smoke from fires, including from planned burns, can also be a hazard within the Barwon South West Region. Those most at risk from smoke exposure include young children, adults over 65 years of age, people with asthma or existing heart or lung conditions, pregnant women, outdoor workers and smokers.⁴⁴

In January 2020, smoke from bushfires across Victoria (and from New South Wales) rendered Melbourne's air quality the worst in the world⁴⁵ with the smoke haze estimated to cost the cities of Melbourne, Sydney and Canberra over \$500 million.⁴⁶

6.3.1 Bushfire prone areas

Bushfire prone areas are designated areas which are subject to or likely to be subject to bushfires, and to which specific bushfire construction standards apply.⁴⁷ Nearly all of the land in the Barwon South West Region is a designated bushfire area.

Table 9. Bushfire Risk in BSWR by LGA⁴⁸

LGA	Bushfire Prone Area (km ²) ⁴⁹	Total Area (km ²) ⁵⁰	% Area Bushfire Prone	Plan Number
Colac Otway Shire	3,377	3,438	98.2%	LEGL./17-383
Corangamite Shire	4,132	4,408	93.7%	LEGL./13-163
Glenelg Shire	6,206	6,219	99.8%	LEGL./14-546
Greater Geelong	1,000	1,248	80.1%	LEGL./20-105
Moyne Shire	5,472	5,482	99.8%	LEGL./17-724
Queenscliffe Borough	3	9	33.3%	LEGL./14-165
Southern Grampians Shire	6,645	6,654	99.9%	LEGL./16-474
Surf Coast Shire	1,514	1,553	97.5%	LEGL./19-223
Warrnambool City	94	121	77.7%	LEGL./20-112
BSWR Total or Average	28,443	29,130	97.6%	

6.4 Waterways

The Barwon sub-region falls predominantly in the boundaries of the Corangamite Catchment Management Authority (CMA), with the catchment area supplying water for agriculture and forestry, domestic and other purposes. Significant waterway assets include the Ramsar-listed wetlands in the Port Phillip Heads Marine National Park and Lake Connewarre Wildlife Reserve.⁵¹

44 DHHS (2020): <https://www2.health.vic.gov.au/public-health/environmental-health/climate-weather-and-public-health/bushfires-and-public-health/smoke-from-fires-and-public-health>

45 The Guardian (2020): <https://www.theguardian.com/australia-news/2020/jan/14/melbourne-choked-by-hazardous-smoke-as-bushfires-continue-to-burn-across-victoria>

46 City of Melbourne (2020): <https://www.melbourne.vic.gov.au/about-council/vision-goals/eco-city/Pages/adapting-to-climate-change.aspx>

47 DELWP (2020): <https://www.planning.vic.gov.au/policy-and-strategy/bushfire-protection/building-in-bushfire-prone-areas>

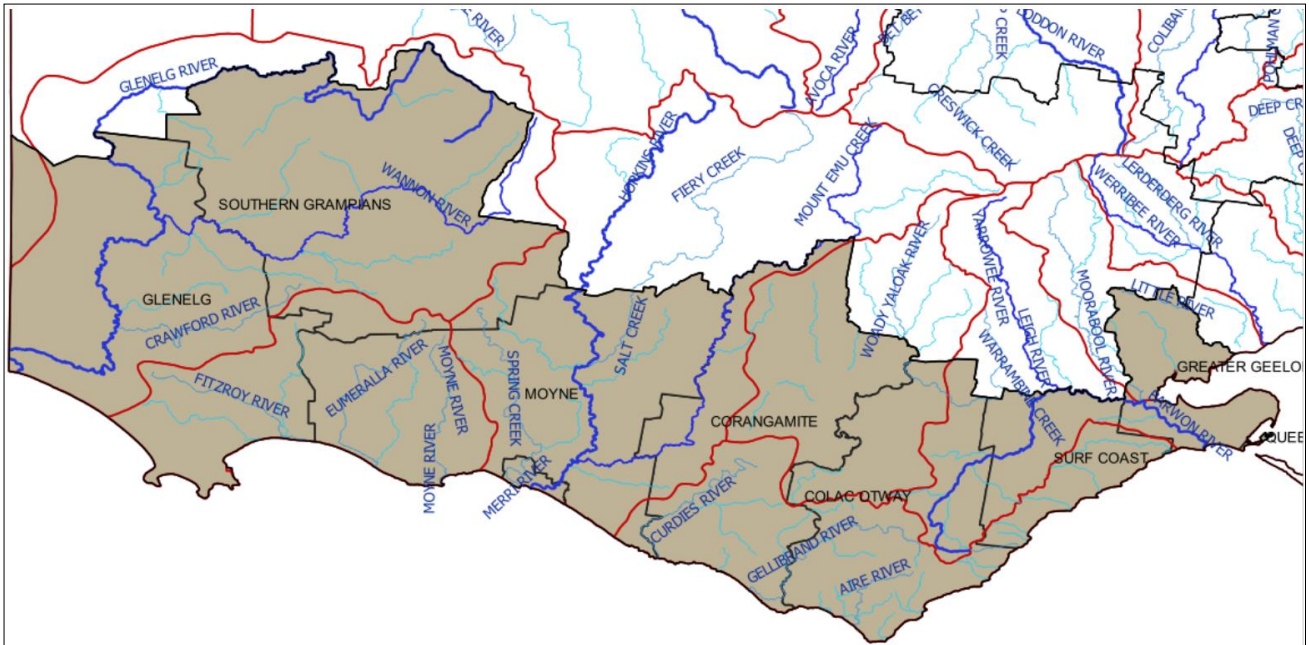
48 DELWP (2020): <https://discover.data.vic.gov.au/dataset/designated-bushfire-prone-area-bpa>

49 DELWP (2020): <https://discover.data.vic.gov.au/dataset/designated-bushfire-prone-area-bpa>

50 DJPR (2020): <https://www.rdv.vic.gov.au/information-portal/table-and-chart>

51 DELWP (2013): <https://www.planning.vic.gov.au/policy-and-strategy/regional-growth-plans/g21-regional-growth-plan>

The Great South Coast sub-region has four basins (Glenelg, Hopkins, Portland Coast and Millicent), with several catchments that drain to the Victorian coast. There are also important wetlands in the sub-region, including the southern extent of the Ramsar-listed Western District Lakes and the Glenelg River estuary.⁵²



Red lines – catchment boundaries
 Dark Blue lines – main rivers
 Light blue lines – main tributaries

Figure 9. Natural waterways in the Barwon South West Region^{53 54}

Natural waterways across the Barwon South West Region have been heavily impacted by historical land use, including clearing and agriculture, which have resulted in poor conditions relative to waterways in the east of Victoria, as shown in Figure 10 below.⁵⁵

52 DJPR (2014): https://www.planning.vic.gov.au/__data/assets/pdf_file/0031/94567/Great-South-Coast-Regional-Growth-Plan-May-2014.pdf

53 Data Vic (2020): <https://discover.data.vic.gov.au/dataset/vicmap-lite>

54 <https://discover.data.vic.gov.au/dataset/awrc-major-river-basins-of-victoria>

55 DELWP (2016): https://www.water.vic.gov.au/__data/assets/pdf_file/0030/58827/Water-Plan-strategy2.pdf

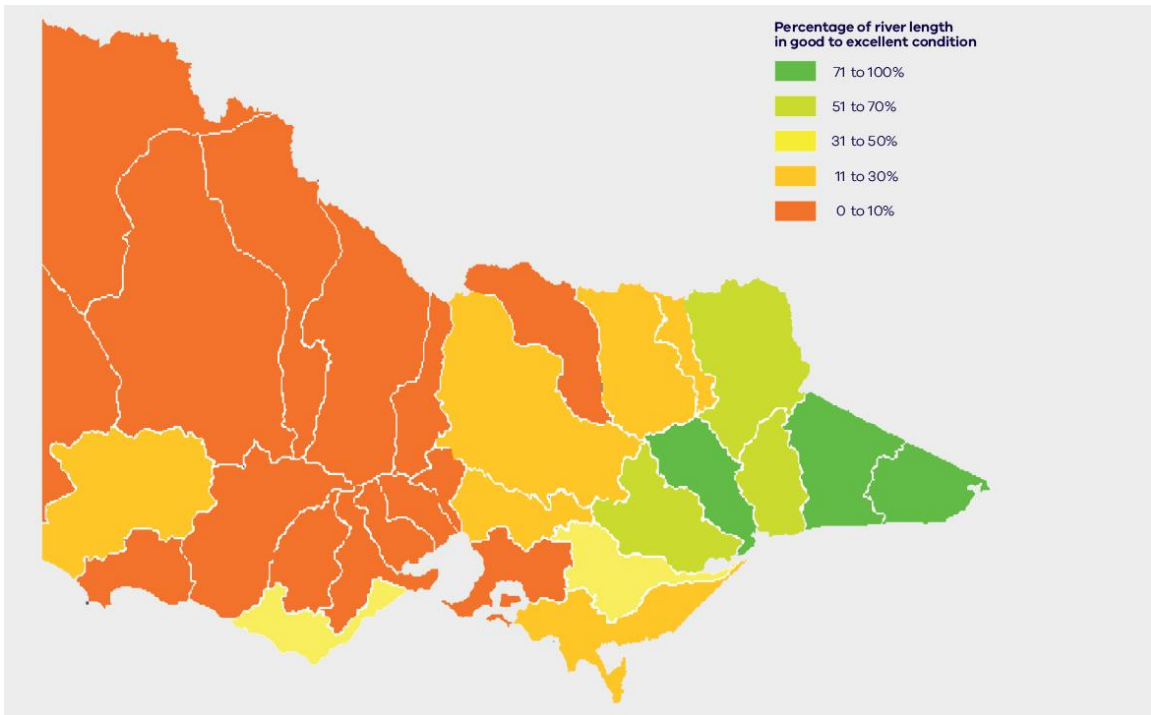


Figure 10. River length condition for Victoria⁵⁶

Many of the waterways mentioned above are managed by appointed waterway managers who are responsible for managing vessel activities on waters under their control. Some of the key roles of waterway managers include providing and maintaining navigational aids, appropriate signage of water levels and hazards, and rules applying to their waters.⁵⁷

⁵⁶ DELWP (2016): https://www.water.vic.gov.au/__data/assets/pdf_file/0030/58827/Water-Plan-strategy2.pdf
⁵⁷ DOT (2020): <https://transportsafety.vic.gov.au/maritime-safety/ports-and-waterways>

Table 10. Managed waterways across the Barwon South West Region⁵⁸

LGA	Waterway Name	Appointed Waterway Manager
Colac Otway Shire	Local Port of Apollo Bay	Colac Otway Shire
	West Barwon Reservoir	Barwon Water
	Aire River downstream of the Great Ocean Road Bridge	DELWP
	Lake Costin	
	Lake Craven	
	Lake Hordern	
	Lake Colac	Director, Transport Safety Victoria
Corangamite Shire	Lake Tooliorook	Corangamite Shire
	Gellibrand River downstream of the bridge at Princetown	DELWP
	Local Port of Port Campbell	Parks Victoria
	Port Campbell Bay	
	Lake Bullen Merri	Director, Transport Safety Victoria
	Lake Purrumbete	Lake Purrumbete Frontage Reserve Committee of Management Inc.
City of Greater Geelong	Barwon River between the Lower Breakwater and Orana Road	Corangamite Catchment Management Authority
	Barwon River upstream of the Local Port of Barwon Heads to the Lower Breakwater, including all the waters within the Lake Connewarre Wildlife Reserve and Reedy Lake	DELWP
	Local Port of Barwon Heads	Barwon Coast Committee of Management Inc.
Glenelg Shire	Local Port of Portland Bay	Glenelg Shire
	Fitzroy River	DELWP
	Glenelg River within Victoria between the mouth and the junction with Crawford River at Dartmouth	
	Malseeds Lake	
	Lake Mombeong	
	Surrey River (upstream of the Princes Highway Bridge)	

⁵⁸ DOT (2020): <https://transportsafety.vic.gov.au/maritime-safety/ports-and-waterways/waterway-managers>

LGA	Waterway Name	Appointed Waterway Manager
	Swan Lake	Committee of Management of Narrawong Camping and Recreation Reserve Corporation
	Bridgewater Lakes (Discovery Bay Coastal Park)	
	Surrey River between the seaward outlet and the Princes Highway Bridge	
Moynes Shire	Local Port of Port Fairy	Moynes Shire
	Lake Surprise (within Mount Eccles National Park)	DELWP
	Curdies River and Curdies Inlet between French's Bridge and the Great Ocean Road Bridge	Curdies Inlet and Recreation Reserve Committee of Management
Southern Grampians Shire	Lake Hamilton	Southern Grampians Shire
	Lake Linlithgow and Bullrush Swamp	
	Rocklands Reservoir	Grampians Wimmera Mallee Water
Surf Coast Shire	Anglesea River from Bass Strait to Coal Mine Road, Anglesea	Surf Coast Shire
	Lake Modewarre at Moriac	
	Lake Murdeduke	
	Painkalac Creek from Bass Strait to Boundary Road, Aireys Inlet	
	Wurdee Boluc Reservoir	Barwon Water
	Browns Swamp	DELWP
	Bass Strait – Anglesea – Point Roadknight	Director, Transport Safety Victoria
	Bass Strait – Anglesea – Torquay	
	Bass Strait – Urquhart Bluff	
Warrnambool City Council	Local Port of Warrnambool	Warrnambool City Council
	Hopkins River between the seaward outlet and Tooram Stones	
	Merri River between the seaward outlet and the Bromfield Street Weir	
	Bass Strait – Warrnambool – Lady Bay	Director, Transport Safety Victoria

Water supplies and catchments are discussed further in Section 7 – Built Environment.

6.4.1 Floods

Floods cause more damage – including loss of life and livelihoods and damage to property and infrastructure – than any other type of natural disaster in Australia.⁵⁹ Victoria is prone to riverine flooding, which occurs in low-lying areas near rivers and streams, and flash flooding, which can happen anywhere in the event of intense rainfall. Flash flooding can be unpredictable, overwhelming drainage systems and causing localised threats.

In the Barwon sub-region, flooding is an important natural phenomenon which supports the movement of water through systems, and there are a number of key floodplains in the area.⁶⁰

In the Great South Coast sub-region flooding presents a moderately severe risk, with the majority of flood hazards in the Glenelg and Southern Grampians shires.⁶¹

Flood management guidelines, including prevention, response and recovery activities, are provided in the *State Emergency Response Plan Flood Sub-Plan*, published in 2016.⁶² The Victorian Government also issued a Victorian Floodplain Management Strategy in 2016 designed to assist communities to better prepare for future floods. This strategy relies on the combined efforts of various agencies including local government, SES, Catchment Management Authorities and community partnerships.⁶³

The Bureau of Meteorology is responsible for providing a flood warning service for riverine flooding resulting from heavy rainfall in Victoria in cooperation with other government, water and emergency management agencies⁶⁴. The coverage of this flood warning service is shown in Figure 11 with both the Flood Watch and Flood Warning catchment shown. The products from the Service Level Specification that cover the catchments in Barwon South West are listed in Table 11⁶⁵. The river observations sites when flood levels are defined are shown as blue triangles and are shown in Figure 11.

59 Flood Victoria (2020): <https://www.floodvictoria.vic.gov.au/>

60 DELWP (2013): https://www.planning.vic.gov.au/__data/assets/pdf_file/0023/94514/G21_Regional_Growth_Plan_-_April_2013_-_low_Res.pdf

61 DJPR (2014): https://www.planning.vic.gov.au/__data/assets/pdf_file/0031/94567/Great-South-Coast-Regional-Growth-Plan-May-2014.pdf

62 EMV (2016): <https://www.ses.vic.gov.au/documents/112015/2504320/State+Emergency+Response+Plan+-+Flood+Sub-Plan+-+Edition+1.pdf/e4d997fa-080b-39fd-366b-42b5cb23443f>

63 DELWP (2016): <https://www.water.vic.gov.au/managing-floodplains/new-victorian-floodplain-management-strategy>

64 http://www.bom.gov.au/water/floods/document/National_Arrangements_V4.pdf

65 http://www.bom.gov.au/vic/flood/brochures/VIC_SLS_current.pdf

Table 11. Flood warning products and flood warning locations for BSWR⁶⁶

Product	Warning Area	Site	Minor	Moderate	Major
IDV36400	Flood Warning for the Barwon River	Barwon River at Geelong	2.3	3.1	4.3
	Flood Warning for the Leigh River	Moorabool River at Batesford Bridge	2.7	4.0	4.9
IDV36520	Flood Warning for the Glenelg River	Glenelg River at Casterton	3.8	5.2	6.0
IDV36510	Flood Warning for the Hopkins River				
IDV36530	Flood Warning for the Moyne River				

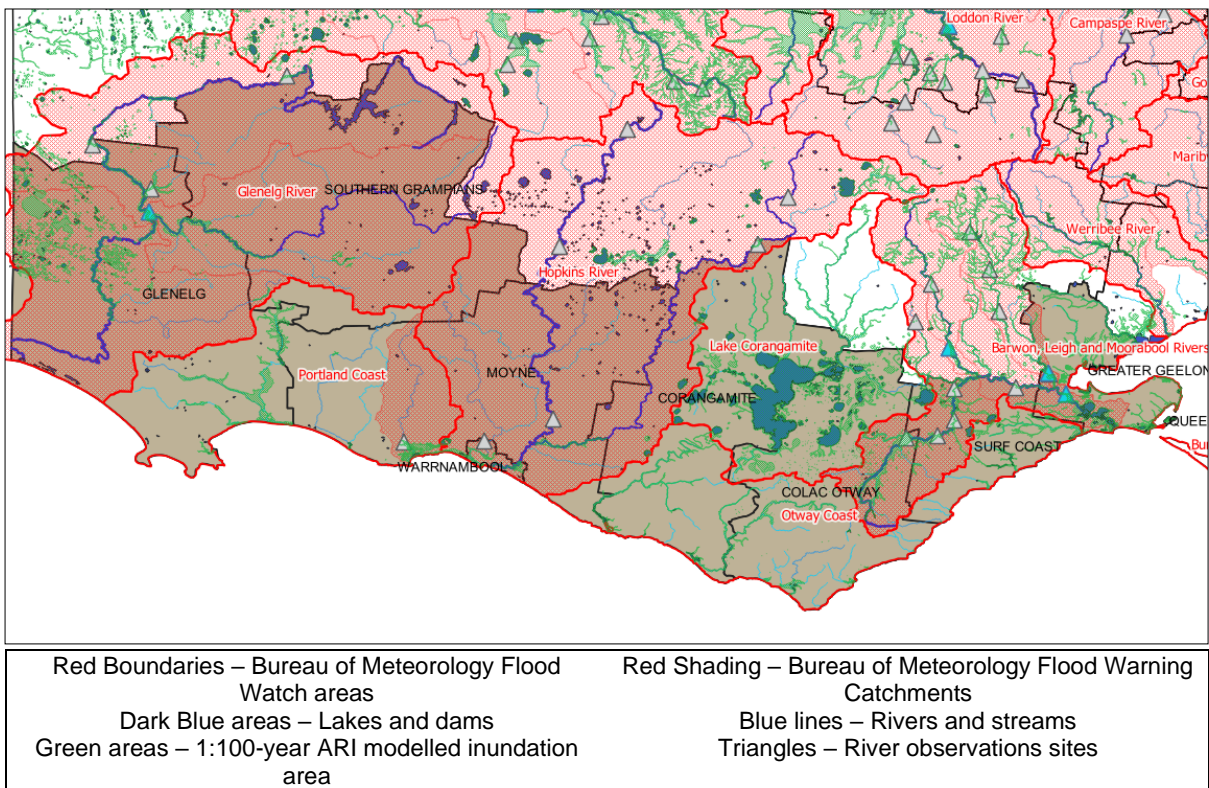


Figure 11: Flood warning and 1:100-year ARI inundation for BSWR^{67 68 69 70 71 72}

The flood risk and area impacted by flooding varies around the region. Table 12 shows the percentage of each LGA which is impacted by flooding at the 1:100-year average recurrence interval (ARI). This is shown in Green in Figure 11. There is a one percent chance (1% annual exceedance probability (AEP)) of these

66 http://www.bom.gov.au/vic/flood/brochures/VIC_SLS_current.pdf

67 <http://www.bom.gov.au/metadata/catalogue/19115/ANZCW0503900441?template=full>

68 <http://www.bom.gov.au/metadata/catalogue/19115/ANZCW0503900561?template=full>

69 <http://www.bom.gov.au/metadata/catalogue/19115/ANZCW0503900563?template=full>

70 <http://www.bom.gov.au/metadata/catalogue/19115/ANZCW0503900564?template=full>

71 <https://discover.data.vic.gov.au/dataset/1-in-100-year-flood-extent>

72 Data Vic (2020): <https://discover.data.vic.gov.au/dataset/vicmap-lite>

areas experiencing flooding of this level in any given year based on flood modelling results from flood studies⁷³. The localities listed have some defined built up area in or near the flood impact area defined by the 1:100-year ARI. This list may not be exhaustive, and some areas may experience impacts from flash flooding due to heavy rainfall that are not shown here.

Table 12. Areas in BSWR potentially impacted by flooding inundation⁷⁴

LGA	% included in 1:100 ARI area ⁷⁵	Main Localities with Affected Built Up Areas
Colac Otway	10.0%	Apollo Bay, Birregurra, Colac, Elliminyt, Wye River
Corangamite	11.5%	Lismore, Port Campbell, Skipton
Glenelg	6.61%	Casterton, Dartmoor, Heywood, Portland
Greater Geelong	13.8%	Barwon Heads, Bell Park, Bell Post Hill, Belmont, Breakwater, Charlemont, Clifton Springs, Corio, Curlewis, Geelong West, Grovedale, Hamlyn Heights, Herne Hill, Highton, Indented Head, Lara, Leopold, Marshall, Moolap, Mount Duneed, Newcomb, Newtown (Geelong), Norlane, North Geelong, North Shore, Ocean Grove, Point Lonsdale, Portarlington, South Geelong, St Albans Park, St Leonards, Wallington, Waurin Ponds, Whittington
Moyne	1.2%	Macarthur, Peterborough, Port Fairy
Queenscliffe	61.2%	Point Lonsdale, Queenscliff
Southern Grampians	0.4%	Coleraine, Hamilton
Surf Coast	8.5%	Aireys Inlet, Anglesea, Connewarre, Fairhaven, Moriac, Torquay, Winchelsea
Warrnambool	10.7%	Allansford, Warrnambool

6.5 Geology

There are significant aspects of the Victorian environment that rely on natural workings underground. Victoria's geology contributes to a large cluster of volcanic plains, the frequency of weak to medium magnitude earthquakes and the versatility of groundwater.

There is an extensive area of volcanism in Victoria. Large basaltic formations (formed after the rapid cooling of lava) are present along the western coast of Victoria. The time of the last volcanic eruption in Victoria is contested by volcanologists, however common consensus is that it occurred approximately 7,000 years ago at Mount Napier. In volcanology terms, this classifies the Western Victorian Volcanic Plains as an active volcanic region, with many volcanologists considering the area dormant rather than extinct.⁷⁶ The plains span approximately 2.3 million hectares or 10% of the state's land mass. The eastern side of Victoria

⁷³ <http://arr.ga.gov.au/arr-guideline>

⁷⁴ <https://discover.data.vic.gov.au/dataset/1-in-100-year-flood-extent>

⁷⁵ <https://discover.data.vic.gov.au/dataset/1-in-100-year-flood-extent>

⁷⁶ http://vro.agriculture.vic.gov.au/dpi/vro/vrosite.nsf/pages/landform_geomorphological_framework_6.1

experienced volcanic activity significantly earlier than in the west.⁷⁷ Older Volcanic Plains are scattered throughout eastern Victoria and as a whole experienced an estimated 400 eruptions that were sporadic, relatively low volume and widespread.⁷⁸

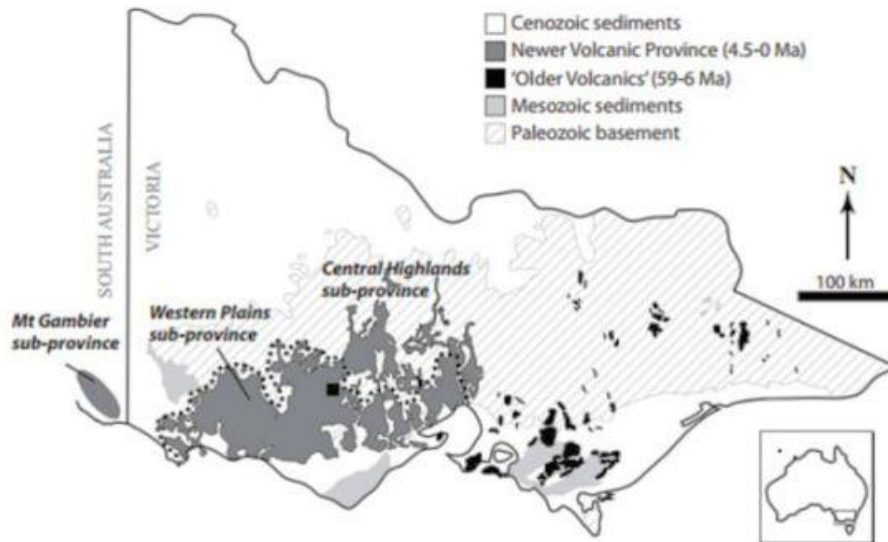


Figure 12. Map of Victoria with Volcanic overlay⁷⁹

The volcanic plains of the Barwon South West region were built up by sporadic volcanic eruptions over a period of about 5 million years, and are known geologically as the Newer Volcanics, the deposits which form the Newer Volcanic Province of Victoria, which includes parts of the Western Uplands, the Western Plains, and the area across the border around Mt Gambier.⁸⁰ Much of the plains were formed from lobes of lava which flowed from the eruption points, overlapping to form a veneer of basalt lava flows. The flow varies in thickness according to both the underlying topography and the present-day surface. The flows are interleaved in places with pyroclastic deposits (scoria and tuff) and discontinuous buried palaeosoils of variable thickness.

Scoria cones, lava shields, composite cones (of both scoria and lava), and maars — indicate the most recent eruptive activity. Mount Anakie (398 m) and Mount Elephant (393 m) on the eastern and western boundary of the Corangamite CMA region respectively, form the highest cones.⁸¹ This scoria cone and shield volcano field last erupted some 5,000 years ago. The two newest eruptive centres are Mounts Gambier and Schank. Both produced a complex eruptive sequence including scoria cone, lava flows and maar formation toward

77 New 40Ar/39Ar ages for selected young (<1 Ma) basalt flows of the Newer Volcanic Province, Southeastern Australia (2011) <https://www.sciencedirect.com/science/article/abs/pii/S1871101411000112>

78 New 40Ar/39Ar ages for selected young (<1 Ma) basalt flows of the Newer Volcanic Province, Southeastern Australia (2011) <https://www.sciencedirect.com/science/article/abs/pii/S1871101411000112>

79 New 40Ar/39Ar ages for selected young (<1 Ma) basalt flows of the Newer Volcanic Province, Southeastern Australia (2011) <https://www.sciencedirect.com/science/article/abs/pii/S1871101411000112>

80 https://www.planning.vic.gov.au/_data/assets/pdf_file/0031/94846/01-The-Western-Volcanic-Plains-Part-1.pdf

81 <https://ui.adsabs.harvard.edu/abs/2012AGUFM.T31B2594R>

the end of the eruptive cycle.⁸² The landform of the Western Volcanic Plain is flat to gently undulating rising only up to 20 metres. This flat plain is dramatically relieved by volcanic features the highest of which is Mount Elephant at nearly 200 metres. Approximately 100 extinct volcanoes can be found in this Character Type in the Western Volcanic Plain.⁸³

On average, there are approximately 100 earthquakes in Australia per year that register above 3 magnitude.⁸⁴ As a nation, Australia experiences significantly less earthquakes than other parts of the world near tectonic boundaries, where large earthquakes occur more often.⁸⁵ However, the country experiences earthquakes due to a series of interlocking, interspersed fault lines that spread throughout the nation. In Victoria, several vault lines have been identified including the Strzelecki Ranges, The Mornington Peninsula and the Otway Ranges. However, the frequency of earthquakes in the state indicates that there are multiple minor fault lines that have not been formally identified.⁸⁶

82 <https://ui.adsabs.harvard.edu/abs/2012AGUFM.T31B2594R>

83 http://vro.agriculture.vic.gov.au/dpi/vro/vrosite.nsf/pages/landform_geomorphological_framework_6.1

84 Geology Australia (2020) <https://www.ga.gov.au/scientific-topics/community-safety/earthquake>

85 Geology Australia (2020) <https://www.ga.gov.au/scientific-topics/community-safety/earthquake>

86 Geology Australia (2020) <https://www.ga.gov.au/scientific-topics/community-safety/earthquake>

Table 13. List of earthquakes above 4.5 magnitude in Victoria since records began^{87 88}

Location	Date	Magnitude	Damage Reported
Cape Liptrap	02 July 1885	5.7	Tied Victoria's largest earthquake – minor damage reported around epicentre
Warrnambool	14 July 1903	5.3	Minor damage over wide geographical area near epicentre
Alpine National Park	10 April 1904	5.0	No damage reported – epicentre in national park
Ocean Grove (offshore)	10 April 1922	5.7	Reports of minor item damage in Cranbourne, East Malvern, Pakenham and Portalington – aftershock 4.7 magnitude
Mornington	03 September 1932	4.5	Minor damage
Bass Strait (offshore)	15 September 1946	6.2	Minor damage reported in Gippsland region and Tasmanian northern coast
Cape Otway	25 December 1950	5.3	No Damage Reported
Mt Hotham	5 May 1966	5.5	Windows broken in ski village
Boolarra	20 June 1969	5.3	5.0 magnitude aftershock, cracked walls and windows near epicentre
Western Port	7 July 1971	5.0	Damage reported in Cowes
Balliang	2 December 1979	4.7	Felt across south eastern suburbs, minor damage caused in Anakie area
Wonnangatta	21 November 1982	5.4	Felt across state, no damage reported
Mount Baw Baw	25 September	5.0	No damage reported
Boolarra	29 August 2000	5.0	Minor damage
Swan Hill	27 October 2001	4.8	Minor damage, power disruption
Wonthaggi	6 March 2011	4.5	No damage reported
Gippsland	19 June 2012	5.4	Minor damage

Groundwater is water found under the ground that flows through layers known as aquifers. Surface water from rainfall seeps into cracks or pores in the ground (aquifers), however aquifers can also be recharged from streams or indirectly from other aquifers.⁸⁹ Groundwater resources eventually flow into rivers, lakes or the ocean. Many surface environments known as 'groundwater dependent ecosystems' rely on groundwater including wetlands and river baseflows. Groundwater is also important as a water resource in semi-arid parts of Victoria where rainfall is infrequent or inadequate to reliably meet water needs.⁹⁰ In areas where groundwater may be replenished on a regular basis (through rainfall), extraction can be managed on a renewable basis. However, in many areas in Australia the extraction greatly exceeds the rate at which

87 Seismology Research Centre (2020) <https://www.src.com.au/earthquakes/older-quakes/>

88 Earthquake Tracker (2020) https://earthquaketrack.com/p/australia/victoria/recent?mag_filter=4

89 Southern Rural Water – Groundwater Atlas (2012) http://www.srw.com.au/wp-content/uploads/2016/03/GGA_SmallSize-1.pdf

90 Geology Australia (2020) <https://www.ga.gov.au/scientific-topics/water/groundwater/basics/what-is-groundwater>

groundwater is replenished - Australian Water Resources 2005 concluded that 30 per cent of groundwater extraction sites were approaching or beyond sustainable extraction limits.⁹¹

Peat consists of decayed vegetation or organic matter. Peat can pose a major fire hazard and a smouldering peat fire cannot be extinguished by light rain.⁹² Peat fuelled fires can burn for extended periods of time and have also been observed as smouldering underground resulting in reignition if an oxygen source is present.⁹³ The minimum rainfall intensity required to extinguish a peat fire is roughly 4mm/h.⁹⁴ In Barwon South West, a significant peat deposit can be found in the west of the region along the border with South Australia. Smaller deposits can be found North of Portland and South East of Hamilton. A full map of peat deposits can be found on EM-COP, below is a screenshot of the BSW region with the peat hazard layer shown in yellow.

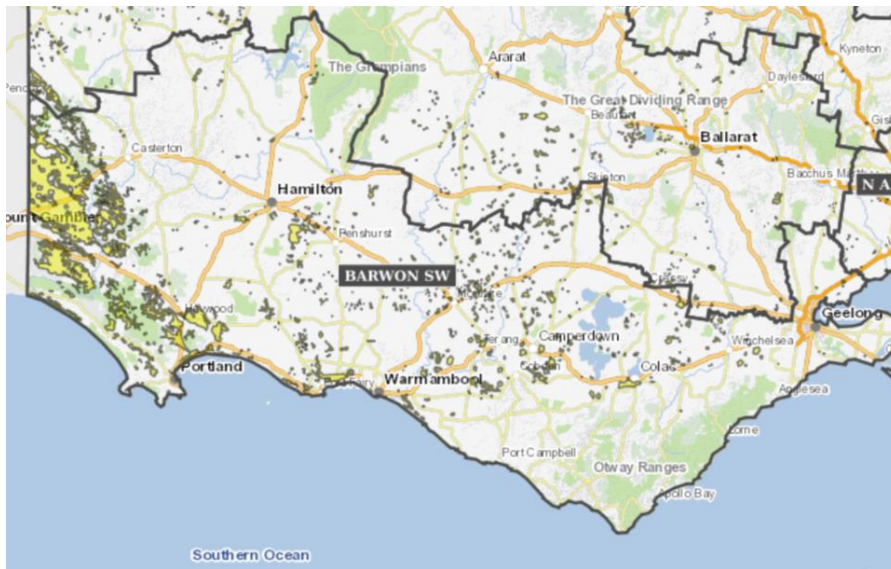


Figure 13 EM-COP layer depicting peat deposits in Barwon South West Region⁹⁵

6.6 Marine

Extending from Werribee through to Portland, this region has substantial rugged coastline and significant seasonal population increases. The region includes mountainous seaside ranges, inland lakes and rivers, Port Phillip Heads, hazardous beaches and coastal cliff lines. This region averages approximately 150 Volunteer MSAR responses annually. Between 1880 and 2015, the sea level around BSW has increased by approximately 225mm, presenting significant risk of extreme sea level events and coastal erosion.⁹⁶

⁹¹ Geology Australia (2020) <https://www.ga.gov.au/scientific-topics/water/groundwater/basics/what-is-groundwater>

⁹² Lin and Huang (2020) <https://www.sciencedirect.com/science/article/abs/pii/S0048969720319811>

⁹³ Lin and Huang (2020) <https://www.sciencedirect.com/science/article/abs/pii/S0048969720319811>

⁹⁴ Lin and Huang (2020) <https://www.sciencedirect.com/science/article/abs/pii/S0048969720319811>

⁹⁵ EM-COP – Peat Overlay Layer

⁹⁶ Climate Ready Victoria – Barwon South West (2015) https://www.climatechange.vic.gov.au/_data/assets/pdf_file/0020/60743/Barwon-South-West.pdf

Local risk factors include:

- Declared Hazardous Water - PPB Heads
- Rising sea levels
- Known flash flooding areas
- ShipWreck Coast
- Very high tourist volumes
- Limited vessel access for prolonged areas
- Commercial Shipping route
- Significant exposure to foul weather
- International Commercial Ports
- Limited safe harbours along coast
- Significant Recreational waterway use

7. Built Environment

Key infrastructure includes major roads and rail lines, water, power, sewerage, telecommunications, airports and seaports, all of which support ongoing growth in the Barwon South West Region.

Extreme weather events threaten critical infrastructure and increase maintenance costs, with critical services such as power, water, sewerage and telecommunications particularly susceptible to extreme weather.

7.1 Information and telecommunications

The communications sector incorporating internet, phone, radio, television, online transactions and business operations is a foundation for economic and social development and stability within Victoria. These interconnected networks are owned by both national and international providers and are regulated by the Commonwealth.⁹⁷

Key assets and infrastructure include:

- Networks – copper, hybrid fibre-coaxial, fibre-optic cable

⁹⁷ EMV (2018): https://files-em.em.vic.gov.au/public/EMV-web/2018_All_Sectors_Resilience_Report.pdf

- Towers – mobile telephone, wireless internet (e.g., 3G, 4G)
- Satellites
- Base stations
- Exchanges or points of interconnect
- Data centres
- Backhaul infrastructure (which transfers high data volumes to and from the core network)
- Cables – between onshore nodes and other countries

Key risks to the sector include:

- Natural disasters – fire, flood, storm, extreme weather
- Pandemic
- Security breaches
- Technical issues (e.g., electricity disruption, asset failure)

In the Barwon South West Region the quality of digital infrastructure, including fixed broadband and mobile access, is highly variable. While for cities and large towns such as Geelong and Warrnambool, access is generally comparable to metropolitan Melbourne, smaller towns and localities such as Batesford and Coleraine generally have less capacity and reliability.⁹⁸

Table 14. Communications Infrastructure in BSW by LGA⁹⁹

LGA	Radio Broadcast	Television Broadcast	Radio Communication	Telephone Exchanges
Colac Otway Shire	8	14	8	27
Corangamite Shire	1	9	0	32
Glenelg Shire	7	13	9	17
Greater Geelong	6	5	2	14
Moyne Shire	8	10	4	34
Queenscliffe Borough	0	0	0	1
Southern Grampians Shire	0	0	4	6
Surf Coast Shire	2	11	8	13
Warrnambool City	2	10	0	2
BSW Total	34	72	35	146

⁹⁸ Infrastructure Victoria (2019): <https://www.infrastructurevictoria.com.au/wp-content/uploads/2019/04/Aither-Barwon-Regional-Profile-March.2019.pdf>

⁹⁹ Data Vic (2020): <https://discover.data.vic.gov.au/dataset/foi-point-vicmap-features-of-interest>

7.2 Energy

Energy – including electricity, gas and liquid fuels is one of eight critical infrastructure sectors identified for Victoria. All three of these sub-sectors are privately owned and operated, and form part of extensive national networks to import and export energy between Victoria and other States.¹⁰⁰

Victoria's primary energy sources are electricity generated from brown coal in the La Trobe Valley, and natural gas sourced from the Gippsland Basin.¹⁰¹

7.2.1 Energy distribution

Energy distribution in the Barwon South West Region is summarised by LGA in the below table and discussed further by form in the following sections.

Table 15. BSWR Energy distribution (km) by LGA¹⁰²

LGA	Energy Distribution (km)		
	Major Electricity Transmission Lines	Oil Pipelines	Gas Pipelines
Colac Otway Shire	97.4	0.0	53.6
Corangamite Shire	304.9	0.0	159.8
Glenelg Shire	200.3	0.0	117.3
Greater Geelong	331.5	57.0	96.7
Moyne Shire	501.2	0.0	282.5
Queenscliffe Borough	0.0	0.0	0.0
Southern Grampians Shire	93.3	0.0	41.3
Surf Coast Shire	86.9	0.0	34.7
Warrnambool City	30.8	0.0	0.0
Total	1,646.3	57.0	785.9

For the energy sector overall, key risks include:

- Fire
- Severe weather
- Extreme temperatures
- Cyber-attack

¹⁰⁰ EMV (2018): https://files-em.em.vic.gov.au/public/EMV-web/2018_All_Sectors_Resilience_Report.pdf

¹⁰¹ DELWP (2020): <https://www.energy.vic.gov.au/>

¹⁰² EMV (2020): Potential Impact Reports (by LGA)

- Earthquake
- Earthworks damaging underground infrastructure
- Loss of communication
- Workforce issues (which could arise for any number of reasons but include industrial issues, heat stress, pandemic, an ageing workforce and lack of experience or specialist staff).¹⁰³

Key dependencies for the energy sector include:

- Production infrastructure
- Supporting infrastructure (e.g., energy supplies for operations)
- Water and wastewater
- Transport infrastructure
- Human resources and management systems
- Information technology and communications¹⁰⁴

7.2.2 Electricity

The key assets and infrastructure for the electricity sector include generators, high and low voltage transmission and distribution systems.¹⁰⁵

Most of Victoria's electricity is generated by brown coal generators in the La Trobe Valley.¹⁰⁶

Terminal stations are key centres for receiving high voltage electricity from transmission lines and converting it to lower voltages for distribution to zone substations.¹⁰⁷ Zone substations receive electricity from bulk supply substations and transform the voltage to 11,000 volts for distribution to customers' homes and businesses along powerlines or cables.¹⁰⁸

Within the Barwon South West Region, there are 9 terminal stations and 0 zone substations which are owned and maintained by Powercor¹⁰⁹, as outlined below:

103 EMV (2018): https://files-em.em.vic.gov.au/public/EMV-web/2018_All_Sectors_Resilience_Report.pdf

104 EMV (2018): https://files-em.em.vic.gov.au/public/EMV-web/2018_All_Sectors_Resilience_Report.pdf

105 EMV (2018): https://files-em.em.vic.gov.au/public/EMV-web/2018_All_Sectors_Resilience_Report.pdf

106 DELWP (2020): <https://www.energy.vic.gov.au/electricity/about-the-electricity-sector>

107 AusNet Services (2018): <https://www.ausnetservices.com.au/-/media/Files/AusNet/About-Us/Determining-Revenues/Distribution-Network/Customer-Forum/Week-1/Networks-101-Customer-Forum.ashx?la=en>

108 AusNet Services (2018): <https://www.ausnetservices.com.au/-/media/Files/AusNet/About-Us/Determining-Revenues/Distribution-Network/Customer-Forum/Week-1/Networks-101-Customer-Forum.ashx?la=en>

109 <https://www.energy.vic.gov.au/electricity/electricity-distributors>

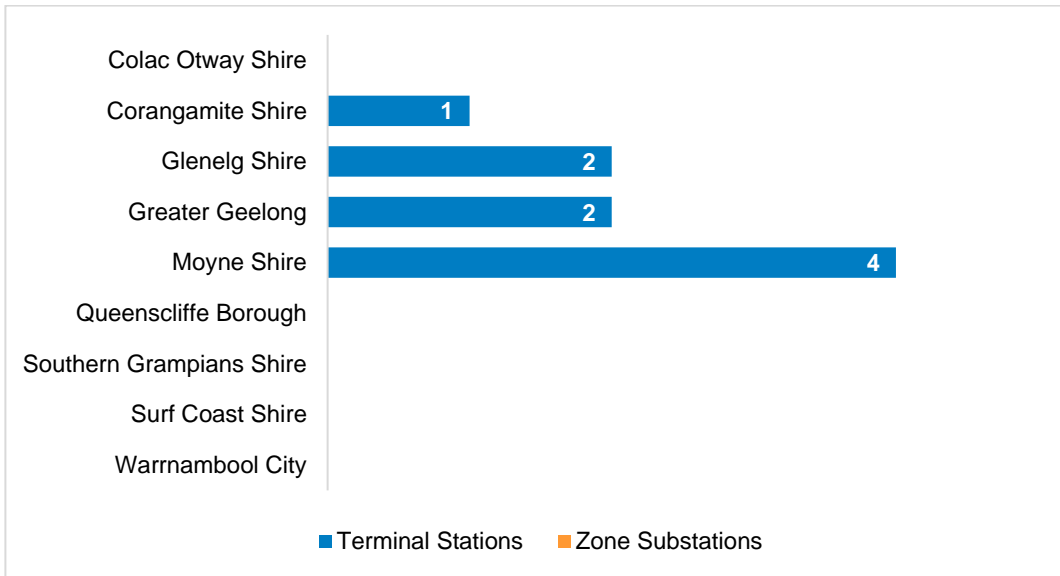


Figure 14: Key terminal stations and zone substations in BSWR by LGA¹¹⁰

A map of electrical infrastructure is provided in Figure 15.

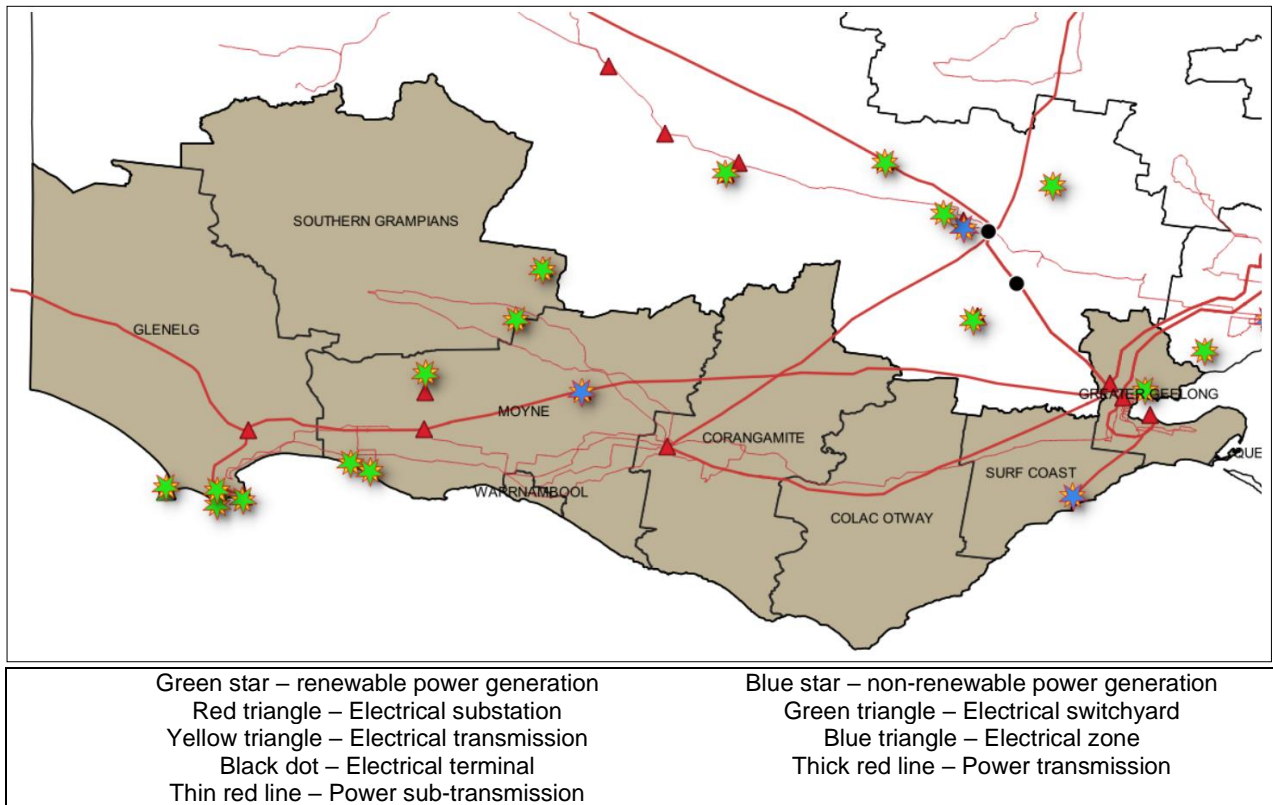


Figure 15. Transmission lines within Barwon South West Region^{111 112 113}

110 EMV (2020): Potential Impact Reports (by LGA)

111 https://data.gov.au/dataset/ds-aurin-aurin%3Adatasource-AU_Govt_GA-UoM_AURIN_DB_national_major_power_stations_2016/details?q=Major%20Power%20Stations

112 https://data.gov.au/dataset/ds-aurin-aurin%3Adatasource-AU_Govt_GA-UoM_AURIN_DB_national_electricity_transmission_substations_2017/details?q=electricity%20transmission%20substations

113 <https://discover.data.vic.gov.au/dataset/foi-line-vicmap-features-of-interest>

7.2.3 Solar and Wind

In the Barwon sub-region renewable energy production sites include the Mt Gellibrand Wind Farm in Colac Otway Shire and the Inverleigh Wind Farm, while in the Great South Coast sub-region renewable energy assets include wind, geothermal and tidal energy.

There are 11 wind farms and no solar farms in the Barwon South West Region, including:

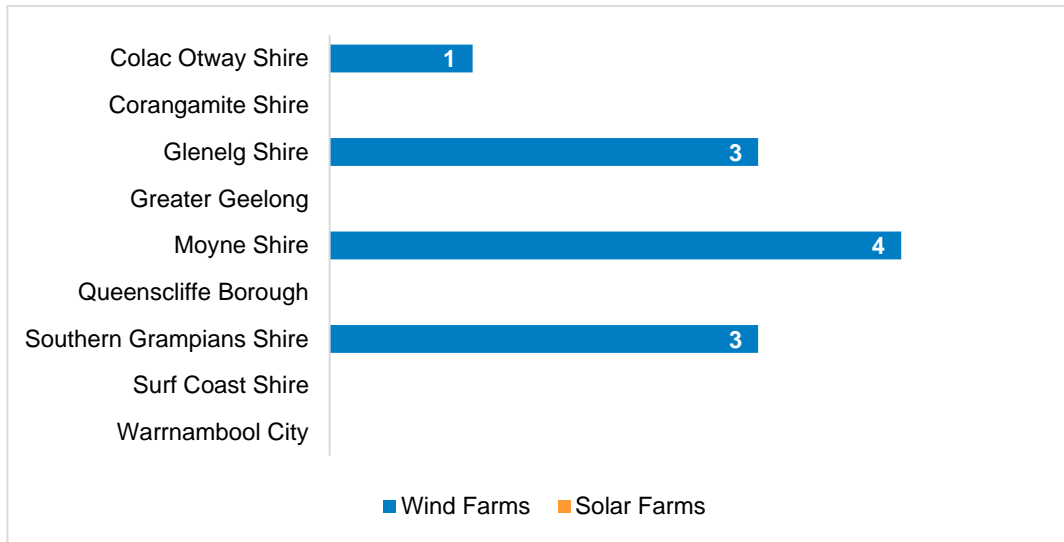


Figure 16. Number of Wind and Solar Farms in BSWR by LGA¹¹⁴

7.2.4 Gas

The key assets and infrastructure for the gas sector include production, receiving, processing and storage facilities, and transmission and distribution systems.¹¹⁵

Victoria’s natural gas supply is sourced predominantly in the Gippsland Basin and processed in Longford. The Principal Transmission System, which covers Melbourne and central Victoria, is owned by GasNet and operated by the Australian Energy Market Operator (AEMO).¹¹⁶

Approximately 780km of gas pipelines traverse the Barwon South West Region, shown in Table 16 and Figure 17.

114 EMV (2020): Potential Impact Reports (by LGA)

115 EMV (2018): https://files-em.em.vic.gov.au/public/EMV-web/2018_All_Sectors_Resilience_Report.pdf

116 DELWP (2017): <https://www.energy.vic.gov.au/gas/about-the-gas-sector>

Table 16. Main gas pipelines in BSWR by LGA¹¹⁷

LGA	Gas Pipelines (km)	Location/Route
Colac Otway Shire	53.6	Lara to Iona
Corangamite Shire	159.8	Casino Gas Field to Iona Curdievale to Cobden Iona to Paaratte Iona to South Australia border Iona Mortlake Lara to Iona Paaratte North to Allansford City Gate Port Campbell Rifle Range to Warre Road
Glenelg Shire	117.3	Allansford to Portland Iona to South Australia border Portland to Portland Smelter
Greater Geelong	96.7	Brooklyn to Corio Brooklyn to Lara Corio to Pt Henry Geelong to Belmont Geelong to Shell Refinery Lara to Iona North Geelong to Waurin Ponds
Moyne Shire	282.5	Allansford to Portland Codrington to Hamilton Curdievale to Cobden Iona to South Australia border Iona Mortlake Paaratte North to Allansford City Gate
Queenscliffe Borough	0.0	N/A
Southern Grampians Shire	41.3	Codrington to Hamilton Iona to South Australia border Supply to Iluka resources
Surf Coast Shire	34.7	Lara to Iona
Warrnambool City	0.0	N/A
Total	785.9	



Figure 17. Natural gas and oil pipelines within the Barwon South Region¹¹⁸

7.2.5 Liquid fuels

The key assets and infrastructure for the liquid fuels sector include production and import facilities, fuel refineries, storage, distribution systems (including pipelines and transport) and retail outlets.¹¹⁹

There is one refinery in the Barwon South West Region, located in Geelong and operated by Viva Energy. It supplies over 50% of Victoria’s and 10% of Australia’s fuel, with fuel manufactured at Geelong available through Shell and Liberty branded service stations.¹²⁰

7.3 Food, grocery and manufacturing

Victoria is the epicentre of manufacturing in Australia, home to more than 13,000 manufacturing firms employing over 280,000 people and generating \$30 billion for the Victorian economy.¹²¹

Several large businesses have their home bases in the Barwon South West Region including:¹²²

- Warrnambool Cheese and Butter Company (Saputo)
- Godfrey Hirst Carpets at Geelong

118 EM-COP – Gas Pipelines Overlay Layer

119 EMV (2018): https://files-em.em.vic.gov.au/public/EMV-web/2018_All_Sectors_Resilience_Report.pdf

120 Viva Energy (2020): <https://www.vivaenergy.com.au/operations/geelong>

121 DJPR (2020): <https://djpr.vic.gov.au/about-us/overview/strategies-and-initiatives/advancing-victorian-manufacturing>

122 RDV (2020): <https://www.rdv.vic.gov.au/victorias-regions/barwon-south-west>

- Quicksilver at Torquay
- Rip Curl at Torquay
- Cotton On at North Geelong
- Portland Aluminium Smelter (Alcoa)

Key assets and infrastructure may include:

- Warehousing and distribution centres
- Complex logistics networks
- Multiple modes of transport

7.3.1 Food supply chain

The safety, security and continuity of Australia's food supply is complicated. It is a nationally distributed system, generally owned and operated by the private sector, with oversight from the Department of Agriculture and Water Resources (DAWR) and other industry and government agencies. However, "States and territories have the lead responsibility for planning for and responding to emergency events within their jurisdictions."¹²³ Emergency situations that could give rise to supply chain disruptions, with downstream effects on consumers, include:

- Pandemic
- Biosecurity concern (e.g., foot and mouth disease)
- Drought
- Industrial action
- Natural disaster
- Severe weather event
- Terrorist attack
- Food or water contamination
- Power, water or communications outage

Figure 18 provides an overview of the food supply chain and its dependencies.

¹²³ DAWR (2020): <https://www.agriculture.gov.au/ag-farm-food/food/food-chain-resilience>

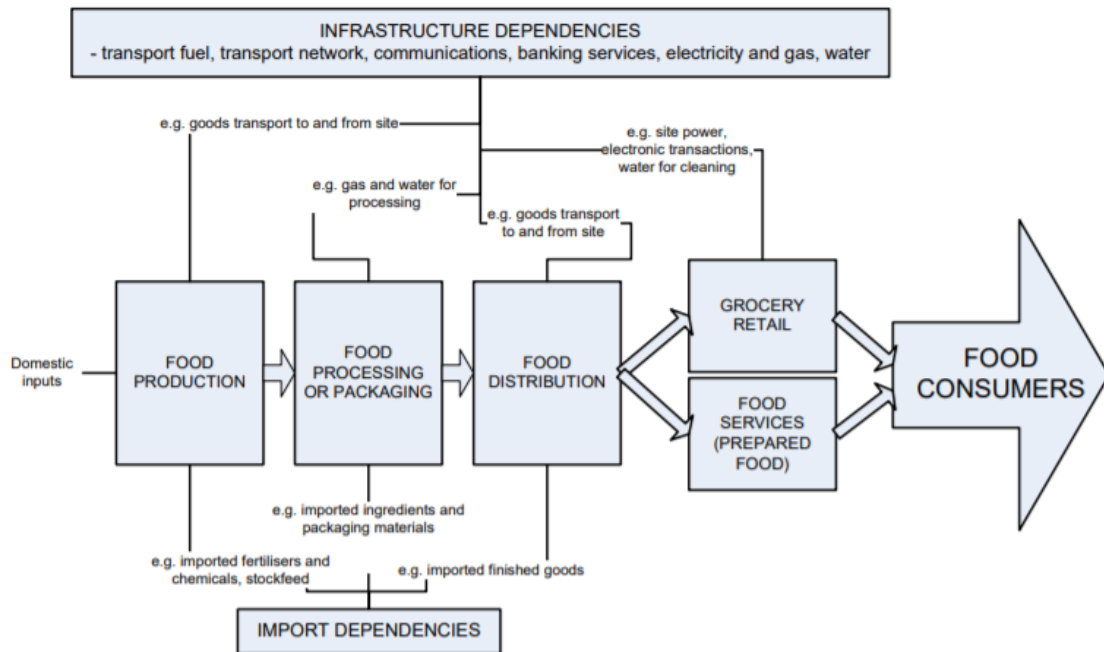


Figure 18. Overview of food supply chain and dependencies¹²⁴

7.4 Transport

The road system in the Barwon South West Region forms part of a radial network focused on Melbourne, Geelong and Ballarat. The two major east-west highways are the Princes Highway and Hamilton Highway. The Glenelg Highway crosses the northern part of the region, linking Ballarat to Hamilton and Mt Gambier in South Australia, while the Great Ocean Road traces the coast. The two major north-south corridors are the Henty Highway between Portland and Hamilton and into the Wimmera region and northern Victoria, along with the Hopkins Highway between Mortlake and Warrnambool.

The most important corridor is the Princes Highway, which links Melbourne, Geelong and the major southern centres of the region, Colac, Camperdown, Terang, Warrnambool, Port Fairy, Portland and then west to Mt Gambier.¹²⁵

The region also contains two railway corridors. The standard gauge line that links Maroona, near Ararat, with Portland is a branch of the Australian Rail Track Corporation corridor between Melbourne and Adelaide, and is used principally for freight traffic. The second rail corridor is the broad-gauge Warrnambool-Geelong-Melbourne line, which carries both freight and passengers.

¹²⁴ DAFF (2012): <https://www.agriculture.gov.au/sites/default/files/sitecollectiondocuments/ag-food/food/national-food-plan/submissions-received/resilience-food-supply.pdf>

¹²⁵ DJPR (2014): https://www.planning.vic.gov.au/__data/assets/pdf_file/0031/94567/Great-South-Coast-Regional-Growth-Plan-May-2014.pdf

The region is also home to the Port of Portland, which is a deep water bulk-handling port that is of state and national significance, while there are also several airports located throughout the region which cater for a range of commercial, emergency and tourism-related services.

Across the Barwon South West Region, the percentage of the population close to public transport declines as the distance from larger population centres increases.

7.4.1 Transport infrastructure

Major transport infrastructure in the Barwon South West Region is outlined below, and discussed further by mode in the following sections:

Table 17. Transport infrastructure (km) in BSWR by LGA (2015)¹²⁶

LGA	Major Roads ¹²⁷	Major Rail ¹²⁸	Distance to Melbourne CBD ¹²⁹	% Population close to Public Transport ¹³⁰
Colac Otway Shire	326.6	70.5	149	41.2%
Corangamite Shire	603.0	118.0	191	8.9%
Glenelg Shire	561.1	60.5	355	33.1%
Greater Geelong	302.5	163.2	78	76.9%
Moyne Shire	598.6	25.2	287	8.5%
Queenscliffe Borough	5.5	0	102	66.9%
Southern Grampians Shire	612.9	88.9	295	40.9%
Surf Coast Shire	110.1	37.5	94	33.2%
Warrnambool City	45.5	20.3	255	72.8%
BSWR Total	3,165.8	584.0		

7.4.2 Roads

More than 3,165km of major roads traverse the Barwon South West Region, including major highways, freeways, arterial roads, bridges and tunnels.

The road network is shown in Figure 19 below, with darker red representing arterial roads, and lighter red municipal roads and tracks. This network includes:

- Princes Freeway/Highway – Melbourne-Geelong-Warrnambool-Portland-Mount Gambier-Adelaide link
- Midland Highway – Geelong-Ballararat-Bendigo-Shepparton-Benalla-Mansfield

¹²⁶ EMV (2020): Potential Impact Reports (by LGA)

¹²⁷ EMV (2020): Potential Impact Reports (by LGA)

¹²⁸ Department of Transport asset database

¹²⁹ DJPR (2020): <https://www.rdv.vic.gov.au/information-portal/table-and-chart>

¹³⁰ DJPR (2020): <https://www.rdv.vic.gov.au/information-portal/table-and-chart>

- Hamilton Highway – Geelong-Cressy-Mortlake-Hamilton link
- Great Ocean Road – Torquay-Lorne-Apollo Bay-Allansford link
- Bellarine Highway – Geelong-Queenscliff-Sorrento (via car ferry) link
- Surf Coast Highway – Geelong-Torquay link
- Hopkins Highway – Warrnambool-Mortlake link
- Glenelg Highway – Ballarat-Skipton-Hamilton-Mount Gambier link
- Henty Highway – Lascelles-Hopetoun-Horsham-Hamilton-Portland link

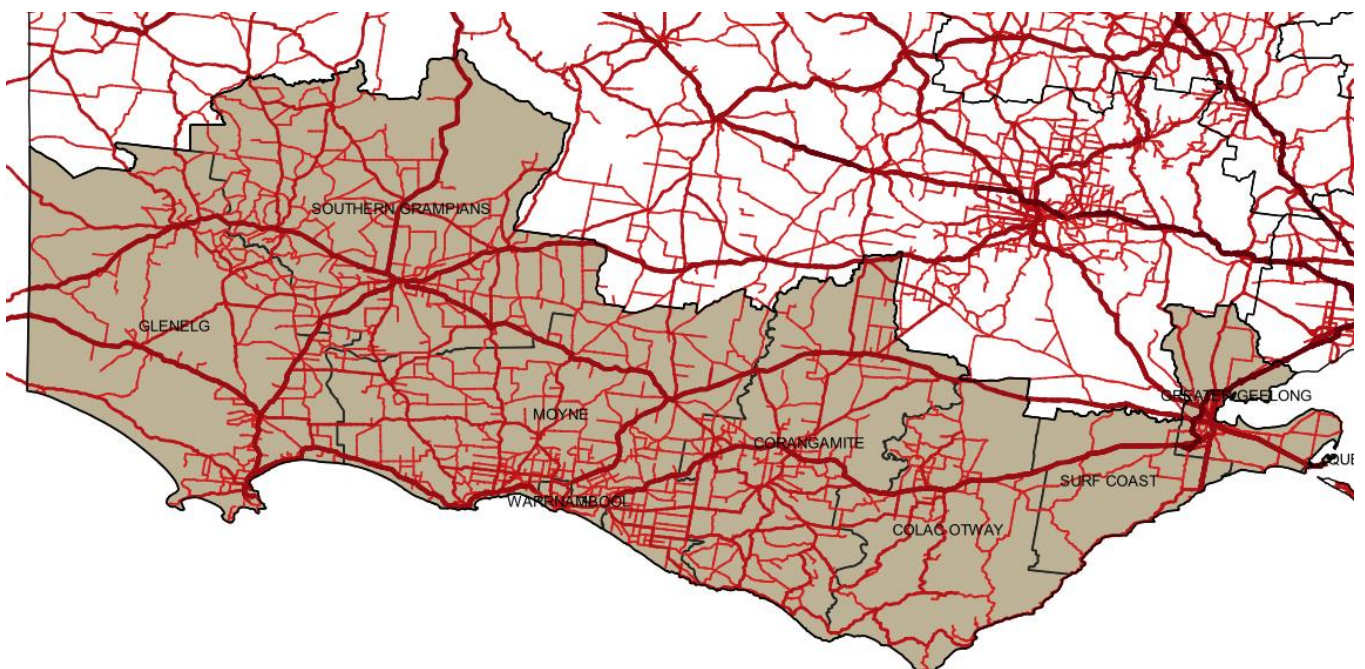


Figure 19. Main roads within the Barwon South West Region¹³¹

131 Data Vic (2020): <https://discover.data.vic.gov.au/dataset/road-network-vicmap-transport>

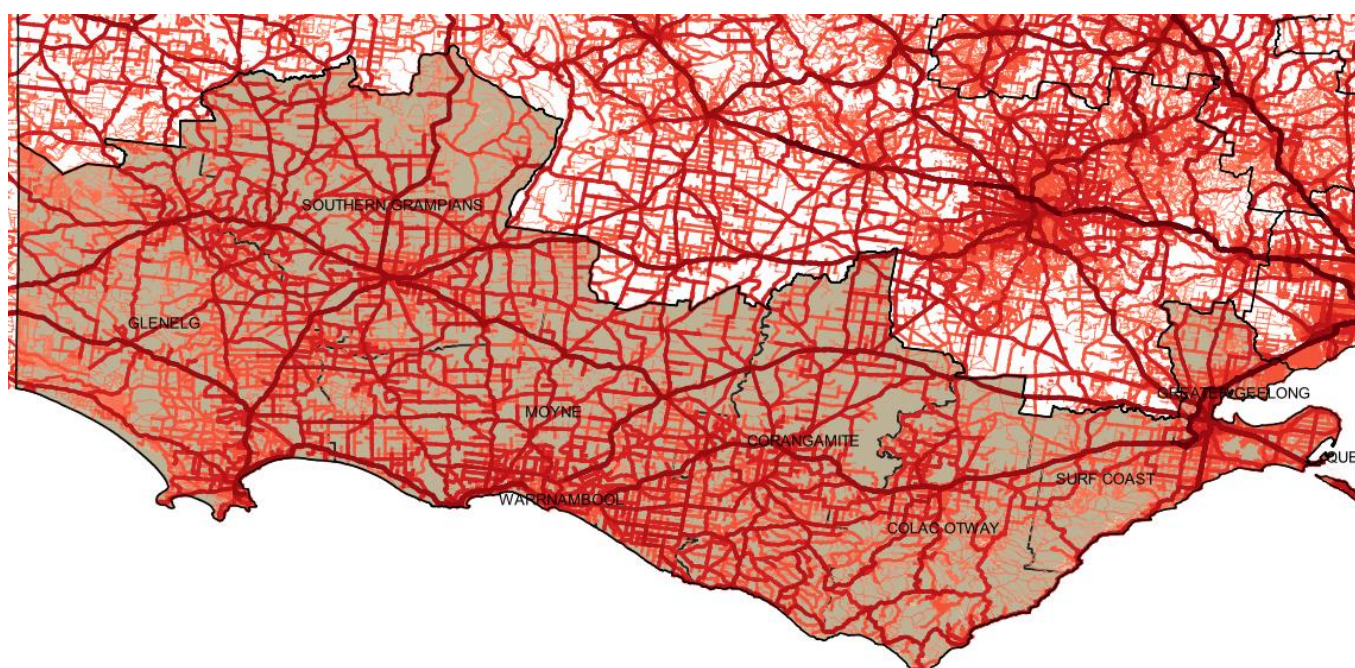


Figure 20. Density of road network within the Barwon South West Region¹³²

The calculated road lengths (km) for each LGA in the Barwon South West Region below are based on the Department of Transport's standard categories:

Table 18. Road Lengths (km) in BSWR by LGA¹³³

LGA	Freeway	Highway	Arterial	Sub-Arterial	Collector	Local	2WD	4WD	Walking Track	Bike Path
Colac Otway Shire	-	60	259	448	-	926	2,083	243	87	119
Corangamite Shire	-	109	371	431	-	1,042	1,575	38	52	29
Glenelg Shire	-	163	250	389	18	1,033	3,260	1,215	135	-
Greater Geelong	122	123	71	262	218	2,052	942	9	105	181
Moyne Shire	-	156	358	1,117	-	862	1,364	76	53	-
Queenscliffe Borough	-	5	-	2	4	43	14	-	5	5
Southern Grampians Shire	-	220	282	834	17	845	1,592	422	57	-
Surf Coast Shire	-	79	52	137	46	588	1,084	273	104	1
Warrnambool City	-	-	43	42	37	255	85	4	21	6
BSWR Total	122	916	1,687	3,662	340	7,646	11,998	2,281	619	341

¹³² Data Vic (2020): <https://discover.data.vic.gov.au/dataset/road-network-vicmap-transport>

¹³³ Data Vic (2020): <https://discover.data.vic.gov.au/dataset/road-network-vicmap-transport>

A listing of the major roads is also provided below:

Table 19. Major roads in BSWR by LGA¹³⁴

LGA	Major Roads	
Colac Otway Shire – 326.6km	Beech Forest - Lovers Hill Rd Beech Forest - Mount Sabine Rd Black Bridge Rd Carlisle Rd Cobden - Stonyford Rd Colac - Lovers Hill Rd Collingwood St Coragulac - Beeac Rd Corangamite Lake Rd Corangamite St Gardner St Gellibrand River Rd Grassy Vale Rd Gravesend St Great Ocean Rd	Hamilton Hwy Irrewillipe Rd Larpent Rd Lovers Hill -Cobden Rd Main Rd Main St Murray St Murray St East Nelson St New Irrewillipe Rd Princes Hwy Sylvester St Timboon - Colac Rd Underwoods Rd
Corangamite Shire – 603.0km	Anderson St Ayresford Rd Bailey St Barrett St Beaufort Rd Camperdown -Cobden Rd Camperdown - Lismore Rd Cobden - Port Campbell Rd Cobden - Stonyford Rd Cobden - Terang Rd Cobden -Warrnambool Rd Cressy St CurdieSt Darlington -Camperdown Rd Estcourt St Foxhow Rd Gellibrand River Rd Glenelg Hwy Glenarmiston Rd Great Ocean Rd Hamilton Hwy	Leura St Lismore -Scarsdale Rd Lismore - Skipton Rd Lismore Rd Lord St Mackinnons Bridge Rd Main St Manifold St Mary Bradshaw Av Mckinnons Bridge - Noorat Rd Montgomery St Morris St Princes Hwy Princetown Rd Robertson St Rokewood - Skipton Rd Skipton - Geelong Rd Skipton Rd Terang - Mortlake Rd Timboon -Colac Rd Timboon - Nullawarre Rd Timboon - Port Campbell Rd Victoria St

134 EMV (2020): Potential Impact Reports (by LGA)

LGA	Major Roads	
	High St Lovers Hill -Cobden Rd	
Glenelg Shire – 561.1km	Bridgewater Rd Burke St Casterton -Edenhope Rd Casterton -Naracoorte Rd Casterton -Penola Rd Casterton Rd Clarke St Coleraire -Merino Rd Dartmoor -Hamilton Rd Edgar St Glereig Hwy HentyHwy Henty St High St Madeira Packet Rd	Mcherson St Mt Gambier Rd Myamyn-Macarthur Rd New St Owen St Portland -Casterton Rd Portland -Nelson Rd Portland Casterton Rd Princes Hwy Shields Tce Smith St Tyrendarra -Etrick Rd Windham St Woolsthorpe -Heywood Rd
Greater Geelong – 302.5km	Aberdeen St Anakie -Geelong Ring In Ramp Anakie -Geelong Ring Out Ramp Anglesea - Geelong Ring In Ramp Anglesea -Geelong Ring Out Ramp Anglesea Rd Avalon -Princes In Ramp Avalon -Princes Out Ramp Bacchus Marsh -Geelong Rd Bacchus Marsh -Geelong Ring In Ramp Bacchus Marsh -Geelong Ring Out Ramp Bacchus Marsh Rd Ballan Rd Ballarat - Geelong Ring In Ramp Ballarat - Geelong Ring Out Ramp Ballarat Rd Barrabool -Geelong Ring In Ramp Barrabool - Geelong Ring Out Ramp Beach -Princes In Ramp Beach -Princes Out Ramp Bellarine Hwy Brocerick -Geelong Ring In Ramp Brocerick - Princes In Ramp Church St Deviation Rd Forest -Princes Out Ramp Geelong -Bacchus Marsh Rd Geelong -Ballan Rd	Geelong Ring In - Princes Ramp Geelong Ring Out -Anakie Ramp Geelong Ring Out -Anglesea Ramp Geelong Ring Out - Bacchus Marsh Ramp Geelong Ring Out -Barrabool Ramp Geelong Ring Out -Hamilton Ramp Geelong Ring Out - Midland Ramp Geelong Ring Out -Princes Ramp Geelong Ring Rd Hamilton -Geelong Ring In Ramp Hamilton - Geelong Ring Out Ramp Hamilton Hwy High St Latrobe Tce Mckillop St Midland Hwy Ormond Rd Point Wilson -Princes In Ramp Princes -Geelong Ring In Ramp Princes -Geelong Ring Out Ramp Princes Fwy Princes Hwy Princes In -Avalon Ramp Princes In -Beach Ramp Princes In -Forest Ramp Princes Out -Avalon Ramp Princes Out -Beach Ramp Princes Out -Point Wilson Ramp Princes Out -Shell Ramp

LGA	Major Roads	
	Geelong Ring In-Anakie Ramp Geelong Ring In-Anglesea Ramp Geelong Ring In -Bacchus Marsh Ramp Geelong Ring In -Ballarat Ramp Geelong Ring In -Barrabool Ramp Geelong Ring In -Hamilton Ramp	Rennie -Princes In Ramp Rollins Rd Settlement Rd Surf Coast Hwy Waurn Ponds Dr
Moyne Shire – 598.6km	Albert St Allansford -Wangoom Rd Ayresford Rd Boundary Rd Brown St CaramutRd Cobden -Warrnambool Rd Commercial Rd Cox St Darlington Rd Dawson St Dunlop St Great Ocean Rd Hamilton - Port Fairy Rd Hamilton Hwy Hamilton St Heckfield St High St Hopkins Hwy Huntly St	Jamieson Av Koroit -Port Fairy Rd Koroit -Woolsthorpe Rd Macarthur - Peshurst Rd Mailors Flat -Koroit Rd Manifold St Mortlake -Ararat Rd Myamyn-Macarthur Rd Peshurst -Port Fairy Rd Peshurst -Warrnambool Rd Princes Hwy Red Lane Regent St Shaw St Six Mile Lane Southern Cross Rd Spencer Rd Terang -Mortlake Rd Timboon -Nullawarre Rd Warrnambool -Caramut Rd Woolsthorpe - Heywood Rd
Queenscliffe Borough – 5.5km	Bellarine Hwy Bethune St Flinders St Hesse St	King St Wharf St Wharf St East
Southern Grampians Shire – 612.9km	Ballarat Rd Bell St Burchett St Cameron St Casterton Rd Coleraine - Bal moral Rd Coleraine -Edenhope Rd Coleraine - Merino Rd Coleraine Rd Cox St Dartmoor - Hamilton Rd Digby Rd	Macarthur - Peshurst Rd Maroona - Glenthompson Rd Martin St Memorial Rd Mt Baimbridge Rd Natimuk - Hamilton Rd Parker St Peshurst -Dunkeld Rd Peshurst -Warrnambool Rd Pope St Portland Rd Riley St

LGA	Major Roads	
	Dunkeld -Cavendish Rd Glendinning St Glenelg Hwy Grampians Rd Hamilton - Port Fairy Rd Hamilton Hwy Hamilton Rd Harrow- Bal moral Rd Henty Hwy Koolomurt Rd Lonsdale St	Scales St Scoresby St Scott St Simson St Stirling St Templeton St Thompson St Victoria Valley Rd Whyte St Winter St
Surf Coast Shire – 110.1km	Bell St Geelong Rd Great Ocean Rd Hurst Dr Main St Mountjoy Pde	Ocean Rd Ocean Rd South Princes Hwy Surf Coast Hwy Willis St
Warrnambool City	Aitken Dr Banyan St Bridge Rd Caramut Rd Craig St Derby St Emma Av Fairy St Fitzroy Rd Flaxman St Foster St Gateway Rd Henna St Hider St Hopkins Hwy	Japan St Kelp St Kepler St Laverock Gr Liebig St Mahoneys Rd Morriss Rd Mortlake Rd Princes Hwy Raglan Pde Rooneys Rd Selby Rd Simpson St Staffords Rd

7.4.3 Rail

Nearly 600km of major rail crosses the Barwon South West Region, including stations, lines and hubs.

The rail network is shown in Figure 21 below and includes: ¹³⁵

¹³⁵ EMV (2020): Potential Impact Reports (by LGA)

- Direct passenger rail line from Geelong to Melbourne and Warrnambool, and Warrnambool to Melbourne.
- Interstate passenger and freight line between Adelaide/Perth and Melbourne via Ararat and Geelong.
- Freight rail access to Port of Melbourne and Port of Geelong from north (via Ballarat) and west (via Warrnambool and Ararat) via Geelong.

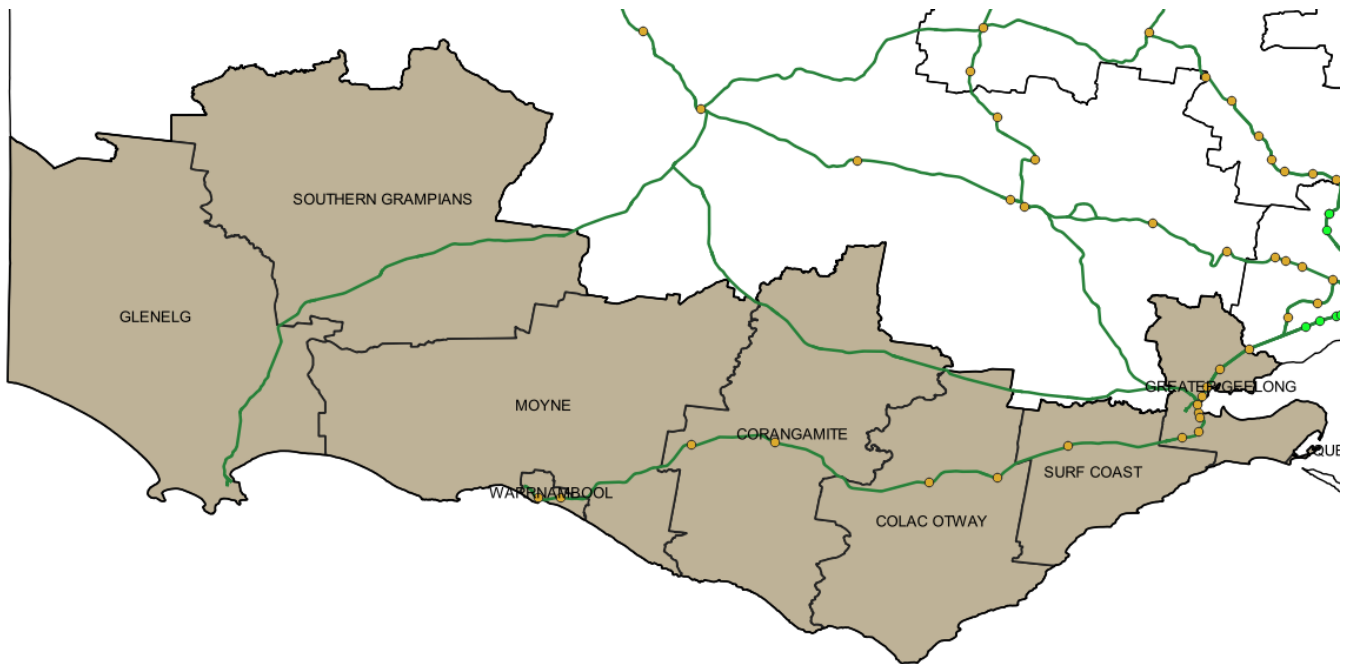


Figure 21. Rail networks in the Barwon South West Region¹³⁶

Train stations

There are nine train stations in BSWR with locations and services as outlined below:

¹³⁶ Data Vic (2020): <https://discover.data.vic.gov.au/dataset/road-network-vicmap-transport>

Table 20. Train stations in BSWR¹³⁷⁻¹³⁸

LGA	No. Train Stations	Station Name(s)	Services	Latitude and Longitude
Colac Otway Shire	2	Colac Railway Station Birregurra Railway Station	V/Line – Warrnambool Line V/Line – Warrnambool Line	-38.343378; 143.586653 -38.328808; 143.783625
Corangamite Shire	2	Terang Railway Station Camperdown Railway Station	V/Line – Warrnambool Line V/Line – Warrnambool Line	-38.236212; 142.911472 -38.228901; 143.150928
Glenelg Shire	0	Nil	Nil	Nil
Greater Geelong	3	Waurin Ponds Railways Station Marshall Railway Station South Geelong Railway Station Geelong Railway Station North Geelong Railway Station North Shore Railway Station Corio Railway Station Lara Railway Station	V/Line – Warrnambool Line V/Line – Warrnambool Line V/Line – Warrnambool Line V/Line – Warrnambool Line V/Line – Warrnambool Line V/Line – Warrnambool Line Journey Beyond – The Overland V/Line – Warrnambool Line V/Line – Warrnambool Line	-38.215814; 144.306819 -38.198549; 144.355057 -38.158659; 144.358987 -38.144242; 144.354989 -38.122835; 144.352272 -38.098377; 144.365321 -38.072831; 144.379768 -38.022428; 144.414404
Moyne Shire	0	Nil	Nil	Nil
Queenscliffe Borough	0	Nil	Nil	Nil
Southern Grampians Shire	0	Nil	Nil	Nil
Surf Coast Shire	1	Winchelsea Railway Station	V/Line – Warrnambool Line	-38.240135; 143.984134
Warrnambool City	1	Sherwood Park Railway Station Warrnambool Railway Station	V/Line – Warrnambool Line V/Line – Warrnambool Line	-38.386392; 142.538871 -38.385014; 142.475545
Total	9			

137 Data Vic (2020): <https://discover.data.vic.gov.au/dataset/foi-point-vicmap-features-of-interest>138 DOT (2020): <https://www.vline.com.au/getattachment/f8a1e2c3-5d60-4abe-b608-2bc18e9f8197/V-Line-Network-Map>

7.4.4 Air

The Barwon South West Region is home to one major airport (Avalon Airport) and several smaller regional airports. Avalon Airport, located in Greater Geelong, is the second busiest of the four airports serving Victoria and offers both domestic and international flights and freight services.

Airports and Aerodromes

The Barwon South West Region is serviced by eight airports/aerodromes, with many registered by the Australian Civil Aviation Safety Authority, as outlined in Table 21. There are several other air bases used for firefighting and emergency evacuations throughout Barwon South West.

Table 21. Registered airports and aerodromes in BSWR by LGA¹³⁹

LGA	No. Airports	Airport Name	Airport Codes
Colac Otway Shire	2	Apollo Bay Airport Colac Airport	ICAO: YAPO ICAO: YOLA
Corangamite Shire	1	Cobden Airfield	ICAO: YCED
Glenelg Shire	2	Portland Airport Casterton Airport	IATA: PTJ; ICAO: YPOD ICAO: YCTN
Greater Geelong	3	Avalon Airport Barwon Heads Airport St Leonards Airfield	IATA: AVV; ICAO: YMAV ICAO: YBRS ICAO: YSTA
Moyne Shire	1	Warrnambool Airport	IATA: WMB; ICAO: YWBL
Queenscliffe Borough	0	Nil	N/A
Southern Grampians Shire	1	Hamilton Airport	IATA: HLT; ICAO: YHML
Surf Coast Shire	0	Nil	N/A
Warrnambool City	0	Nil	N/A
Total	8		

7.4.5 Sea

Ports and their associated infrastructure are important gateways for the import and export of goods. Indeed, it is estimated that Australia conducts 98% of its trade through ports, which play a pivotal role in the national's supply chain.¹⁴⁰

Key risks to the sector include:

- Disruptions to human resources.
- Disruptions to electricity supply or liquid fuel.

¹³⁹ CASA (2020): <https://www.casa.gov.au/aerodromes/aerodromes-register/registered-aerodromes>

¹⁴⁰ Ports Australia (2020): <https://www.portsaustralia.com.au/resources/trade-statistics>

- Transport infrastructure emergencies.
- Disruptions to major non-transport infrastructure.
- Security events.¹⁴¹

There are two major commercial ports located in the Barwon South West Region:

Port of Geelong

Located in Corio Bay, Port of Geelong comprises 15 berths across two primary precincts; Corio Quay and Lascelles. It is the second largest port in Victoria and handles more than 11 million tonnes of product annually across a broad range of industries, including crude oil, woodchip, fertiliser and break bulk cargo. The port handles over 600 vessel visits every year, with most of the shipping activity linked to the bulk liquid berth at Refinery Pier.¹⁴²

Port of Portland

Located in Portland and Victoria's only natural deep-water port, Port of Portland comprises six berths and handles 7.5 million tonnes of product annually, 5 million of which are forestry products. It supports the agriculture, forestry and mining industries across the Wimmera Mallee, Green Triangle and Murray Basin regions extending from northern and western Victoria to south-east South Australia. The port handles 300 ships per annum.¹⁴³

In addition to the two commercial ports at Geelong and Portland, there are also seven local ports located in the Barwon South West Region. These local ports provide services to the commercial fishing industry, charter boats and recreational fishing and boating interests, while being key recreation and tourist assets that provide significant contributions to local economies.¹⁴⁴ Local ports in the region are shown in Figure 22 include:

- Local Port of Portland Bay – port manager is Glenelg Shire Council.
- Local Port of Warrnambool – port manager is Warrnambool City Council.
- Local Port of Port Fairy – port manager is Moyne Shire Council.
- Local Port of Port Campbell – port manager is Parks Victoria.
- Local Port of Apollo Bay – port manager is Colac-Otway Shire Council.
- Local Port of Lorne – port manager is Great Ocean Road Coast Committee.
- Local Port of Barwon Heads – port manager is Barwon Coast Committee of Management Inc.

¹⁴¹ EMV (2019): <https://www.emv.vic.gov.au/publications/victorias-critical-infrastructure-all-sectors-resilience-report-2018>

¹⁴² Geelong Port (2020): <https://geelongport.com.au/about/>

¹⁴³ Port of Portland (2020): <https://www.portofportland.com.au/about/port-profile/about-the-port/>

¹⁴⁴ DOT (2020): <https://transport.vic.gov.au/ports-and-freight/about-victorias-local-ports>



Figure 22. Local Ports in Victoria¹⁴⁵

7.5 Water and Wastewater

Treated water supplies and wastewater services are essential to human health, liveability and the environment. As the population grows and expands across Victoria the criticality of these services and their associated infrastructure will also increase.

7.5.1 Water

The Barwon sub-region is home to several water storages, the most important being the West Barwon Reservoir and Wurdee Boluc Reservoir, while the Great South Coast sub-region is home to the Rocklands Reservoir, which is the primary storage for the Glenelg River.

Water security is heavily impacted by both long-term trends, such as increasing population growth, urbanisation and climate change as well as sudden events, including floods and oil spills. Some examples of the impacts include:

- Diminished agricultural production leading to a decline in gross domestic product.
- Health risks, such as blue-green algae outbreaks, which can be triggered by changes in nutrients and salinity, storage volumes, water flow and warmer weather. Large numbers of blue-green algae can produce toxins harmful to humans, animals, birds, livestock and the environment.¹⁴⁶

¹⁴⁵ DOT (2020): <https://transport.vic.gov.au/ports-and-freight/about-victorias-local-ports>

¹⁴⁶ DELWP (2020): <https://www.water.vic.gov.au/waterways-and-catchments/rivers-estuaries-and-waterways/blue-green-algae>

- An increasing reliance on groundwater, which in Victoria is primarily used by dairy farms and other livestock, for irrigating crops, power generation and town water supplies.¹⁴⁷

In a range of emergencies, including blue-green algae incidents, dam safety issues and disruption to water services, DELWP is charged with responsibility for responding to and mitigating the impact of such events.¹⁴⁸

Since 2006 the water sector has been identified as an essential service according to an Act of Parliament,¹⁴⁹ which requires Victoria's water organisations to have risk management plans in place which include provisions for terrorist acts. Water resources are also particularly susceptible to all hazard events, including bushfires, drought, floods, earthquakes, cyclones, contamination and epidemics. Individual disruptions to infrastructure in one area can have an impact on the response and recovery efforts in other areas because water is both dependent and interdependent on infrastructure networks across Victoria. For example, water supplies rely on electric power to operate distribution pumps while electric power requires water for electricity generation. So too, the water sector relies on supply chains, including the transport sector, to provide chemicals for water treatment and disinfection and may share common service corridors.¹⁵⁰

Several government departments and agencies share responsibility for managing and protecting Victoria's bays, rivers and ports, including:

- Parks Victoria
- Fisheries Victoria
- Department of Environment, Land, Water and Planning (DELWP)
- Department of Transport
- Environmental Protection Agency (EPA)
- Water Police¹⁵¹

Key water storages in the Barwon South West region are managed by Barwon Water.

147 DELWP (2020): <https://www.water.vic.gov.au/groundwater/victorias-groundwater-resources>

148 DELWP (2019): <https://www.water.vic.gov.au/managing-dams-and-water-emergencies/emergency-management>

149 The Terrorism (Community Protection) Act 2003.community protection

150 Global Terrorism Research Centre (2015):

https://www.researchgate.net/publication/275658307_Plan_Prepare_and_Safeguard_Water_Critical_Infrastructure_Protection_in_Australia

151 Parks Victoria (2020): <https://www.parks.vic.gov.au/water-management>

Reservoirs

There are 10 reservoirs and storage basins in the Barwon South West Region, as outlined below:

Table 22. Key reservoirs and storage basins in BSWR¹⁵²

LGA	No. Reservoirs	Reservoir name(s)	Capacity (ML)	Water Authority
Colac Otway Shire	5	West Barwon Reservoir	21,504	Barwon Water
		West Gellibrand Reservoir	1,860	
		Olangolah Reservoir	152	
		Marengo Basin	125	
		Apollo Bay Basin	250	
City of Greater Geelong	2	No. 4 Basin Colac	192	Barwon Water
		No. 5 Basin Colac	450	
Southern Grampians Shire	1	Rocklands Reservoir	348	Grampians Wimmera Mallee Water
Surf Coast Shire	2	Wurdee Boluc Reservoir	38,056	Barwon Water
		Allen Reservoir	215	
Total	10			

For areas with mains drinking water, most of these systems are treated to potable standard meeting the Australian Drinking Water Guidelines. While the main systems are predominately based around surface water supplies from reservoirs, there are also some communities that rely on groundwater for drinking water. Table 23 outlines the areas serviced by water supply systems in the region. These include networks of system storages (tanks and basins), pumping stations and pipes.

In areas where mains drinking water is not available, rural communities rely on local rainwater, groundwater and surface water sources as private water supplies¹⁵³. Understanding where these sources might be is important when looking at the impacts of a range of water quality and contamination events including waterborne diseases, chemical runoff, aquifer contamination and airborne particulates.

¹⁵² DELWP (2020): <https://www.water.vic.gov.au/water-reporting/water-in-your-region>

¹⁵³ <https://www2.health.vic.gov.au/public-health/water/private-drinking-water>

Table 23. Key water providers and water supply systems^{154 155 156}

Provider	Supply System	Source
Barwon Water	Greater Geelong	Barwon
		West Moorabool
		East Moorabool
		Barwon Downs Borefield
		Anglesea Borefield
		Greater Yarra System
	Colac	West Gellibrand Olangolah Reservoirs
Apollo Bay and Skenes Creek	Barham River	
Lorne	St Georges River	
Gellibrand	Lardner Creek	
Wannon Water	Otway	Arkins Creek Gellibrand River Carlisle River bores Albert Park bores Warrnambool bores
	Dilwyn Aquifer	Groundwater bores at: Portland Port Fairy Heywood Dartmoor Port Campbell
	Grampians	Victoria Ranges (Hamilton) Dunkeld Headworks Creek
Grampians Wimmera Mallee Water	Balmoral	Balmoral
	Glenthompson (part of Willaura System)	Yuppeckiar Creek Willaura pipeline
Wannon Water	Bridgewater Formation	Tulich borefield Konongwootong Reservoir
	Newer Volcanic Aquifer	Groundwater bores at: Penhurst Caramut Mortlake
	Clifton Formation	Macarthur bore

154 https://www.barwonwater.vic.gov.au/_data/assets/pdf_file/0008/20501/Urban-Water-Strategy-2017-notation.pdf

155 <https://www.wannonwater.com.au/media/52783/urban-water-strategy-2017-2065-revised-cover-version.pdf>

156 https://www.gwmwater.org.au/images/Urban_and_Rural_Water_Strategy_2017_-_Final_July_6_2017.pdf

7.5.2 Emergency water supply points

Victoria has more than 300 emergency water supply points, overseen by DELWP and managed by various state agencies, for use during drought and bushfires. Some can be used to supply water to firefighting vehicles.¹⁵⁷

7.5.3 Wastewater

There are also numerous water and wastewater treatment plants across the region, with plants in most towns and multiple plants spread across each LGA. Wastewater treatments plants are regulated by the Victorian Environment Protection Authority (EPA).

Wastewater can be treated to different levels to allow reuse activities and support safe discharge to the receiving environment. Class A is the highest grade of recycled water and can be used in residential areas and to irrigate food crops. Class D is the lowest class and can only be used in areas with low risk of human contact such as irrigation outside of agricultural food production¹⁵⁸. Most treatment plants in Barwon South West treat water to Class C standard or above for recycled use or discharge to environment¹⁵⁹. Table 24 summarises the areas in the region serviced by wastewater treatment systems. These systems comprise gravity pipes, access points, pump stations and rising mains. Local Governments are responsible for the regulation of septic tanks in areas without sewerage systems.

157 DELWP (2020): <https://data.aurin.org.au/dataset/vic-govt-delwp-datavic-water-ewsp-na>

158 https://ref.epa.vic.gov.au/our-work/licences-and-approvals/~/_media/Publications/464%202.pdf

159 <http://www.barwonwater.vic.giv.au/water-and-waste/sewage>

Table 24. Key sewerage service providers and service areas ^{160 161}

Provider	Service area	Treatment Plant
Barwon Water	Greater Geelong	Anglesea
		Aireys inlet
		Birregurra
		Connewarre (Black Rock)
		North Shore (Northern Water Plant)
		Portarlington
		Winchelsea
	Colac	Colac
	Apollo Bay	Apollo Bay
	Lorne	Lorne
Wannon Water	Camperdown	Camperdown domestic Camperdown industrial
	Casterton	Casterton
	Cobden	Cobden
	Coleraine	Coleraine
	Dunkeld	Dunkeld
	Hamilton	Hamilton
	Heywood	Heywood
	Mortlake	Mortlake
	Peterborough	Peterborough
	Port Campbell	Port Campbell
	Portland	Portland
	Port Fairy	Port Fairy domestic Port Fairy industrial
	Simpson	Simpson
	Terang	Terang
	Timboon	Timboon
Warrnambool	Warrnambool	

160 https://www.barwonwater.vic.gov.au/_data/assets/pdf_file/0008/20501/Urban-Water-Strategy-2017-notation.pdf161 <https://www.wannonwater.com.au/media/62830/wannon-water-2018-19-annual-report-final.pdf>

7.6 Waste and recycling

7.6.1 Landfill

Landfill, the below ground disposal of waste materials that cannot be recycled continues to be a part of Victoria's waste management strategy. Many landfill sites are licensed to accept low-hazard (Category C) industrial waste. However, prescribed industrial waste can only be accepted at one hazardous (Category B) landfill in Victoria. This is located on Taylors Road in Dandenong South in the City of Greater Dandenong.¹⁶²

Closed landfills also pose environmental risks, including from:

- Leachate, a liquid formed by decomposing waste and rainwater, which can contaminate groundwater; and
- Landfill gas from decomposing waste, which can migrate to the atmosphere.¹⁶³

A study conducted by the Fire Services Commissioner in 2012 found that a series of significant fires in Victorian landfill sites had been costly and resource intensive for fire services to suppress. The need to work more closely with operators of landfill sites was identified as a recommendation to improve operating practices and develop fire management plans.¹⁶⁴

There are currently 27 sites in the Barwon South West Region listed in the EPA's Priority Sites Register which have been issued a Clean Up Notice or a Pollution Abatement Notice, as the current condition of the sites is incompatible with the current or approved usage and poses a risk to human health or the environment.¹⁶⁵ Examples of contamination and pollution issues experienced in the region include former landfill sites, current and former industrial sites, current and former service stations, current petroleum storage sites and dumped industrial waste.¹⁶⁶

There are 97 landfill sites across the region, as shown in Table 25.

¹⁶² EPA Victoria (2020): <https://ref.epa.vic.gov.au/your-environment/waste/landfills>

¹⁶³ EPA Victoria (2020): <https://ref.epa.vic.gov.au/your-environment/waste/landfills/closed-landfills.html>

¹⁶⁴ EMV (2012): <https://www.emv.vic.gov.au/how-we-help/reviews-and-lessons-management/operational-reviews/fire-management-at-landfill-sites>

¹⁶⁵ EPA Victoria (2020): <https://www.epa.vic.gov.au/for-community/environmental-information/land-groundwater-pollution/priority-sites-register>

¹⁶⁶ <https://www.epa.vic.gov.au/for-community/environmental-information/land-groundwater-pollution/priority-sites-register>

Table 25. Landfill site status in BSWR by LGA¹⁶⁷

LGA	No. Landfill Sites	Operating Status and Waste Type
Colac Otway Shire	9	Tyres, solid inert waste – 1 Closed – 8
Corangamite Shire	6	Tyres, solid inert waste, general waste, food waste and green waste – 1 Closed – 6
Glenelg Shire	15	Closed – 15
Greater Geelong	35	Asbestos, tyres, solid inert waste – 1 Cement kiln dust – 1 PIW, tyres, asbestos, solid inert waste, general waste, animal effluent – 1 Closed – 32
Moyne Shire	16	Closed – 16
Queenscliffe Borough	0	N/A
Southern Grampians Shire	9	Tyres, solid inert waste and general waste – 1 Closed – 8
Surf Coast Shire	5	Ceramic-based fibres, asbestos, leached ash, water treatment waste – 1 Solid inert waste, general waste – 1 Closed – 3
Warrnambool City	2	Closed – 2
Total	97	

7.6.2 Recycling

There are 38 transfer stations and 80 stockpile sites registered by the EPA (waste in storage for recycling or reuse), across the region as shown in Table 26.

¹⁶⁷ <https://discover.data.vic.gov.au/dataset/foi-point-vicmap-features-of-interest>

Table 26. Transfer stations and EPA stockpiles in BSWR^{168 169}

LGA	No. Transfer Stations	No. EPA Stockpile Sites
Colac Otway Shire	5	11
Corangamite Shire	5	10
Glenelg Shire	2	5
Greater Geelong	2	26
Moyne Shire	11	8
Queenscliffe Borough	0	0
Southern Grampians Shire	7	6
Surf Coast Shire	5	5
Warrnambool City	1	9
BSWR Total	38	80

7.7 Government services

Regional emergency management plans should consider how to ensure the continuation of government services to the community during an emergency – a time when they are likely to need vital support. The coronavirus pandemic of 2020 has already demonstrated the precarious nature of government workforces and the impact that absenteeism as a direct consequence of a disaster can have flow on effects (e.g., health care workers in an emergency department who are required to self-isolate for a period of 14 days following exposure to the virus can lead to the closure of wards or the cessation of elective surgeries which may lead to diversions for Ambulance Victoria and other care settings being required to pick up the slack).

Government services not already covered in this scan include prisons, community correctional services and law courts, which can have their own unique issues in the face of an emergency.

7.7.1 Prisons and community correctional facilities

There are two prisons/community correctional facilities in the Barwon South West Region, both in Greater Geelong:

- HM Prison Barwon
- Marngoneet Correctional Centre¹⁷⁰

7.7.2 Law Courts

There are two County Courts and five Magistrates courts in the region, as outlined below:

168 Data Vic (2020): <https://discover.data.vic.gov.au/dataset/foi-point-vicmap-features-of-interest>

169 EMV (2020): Potential Impact Reports (by LGA)

170 EMV (2020): Potential Impact Reports (by LGA)

Table 27. Law Courts in BSWR by LGA¹⁷¹

LGA	No. Courts	Name
Colac Otway Shire	1	Colac Magistrates Court
Corangamite Shire	0	N/A
Glenelg Shire	1	Portland Magistrates Court
Greater Geelong	2	Geelong Magistrates Court Geelong County Court
Moyne Shire	0	N/A
Queenscliffe Borough	0	N/A
Southern Grampians Shire	1	Hamilton Magistrates Court
Surf Coast Shire	0	N/A
Warrnambool City	2	Warrnambool Magistrates Court Warrnambool County Court
Total	7	

7.8 Emergency services

The Barwon South West Region is served by 33 ambulance stations, 43 police stations, 241 fire stations, 23 SES units, 16 Life Saving Victoria (LSV) units and 4 Coast Guard flotillas.

7.8.1 Ambulance

There are 33 ambulance stations across the region.¹⁷²

Table 28 outlines ambulance response time performance for Code 1 calls across LGAs in BSWR.

171 Data Vic (2020): <https://discover.data.vic.gov.au/dataset/foi-point-vicmap-features-of-interest>

172 Data Vic (2020): <https://discover.data.vic.gov.au/dataset/foi-point-vicmap-features-of-interest>

Table 28. Ambulance stations and Code 1 response times for BSWR by LGA¹⁷³

LGA	No. Stations	Locations	Code 1 – % Responses within 15 mins	Code 1 – Average Response Time (mins)
Colac Otway Shire	3	Apollo Bay, Colac, Lavers Hill	64.7%	16:19
Corangamite Shire	6	Camperdown, Cobden, Lismore, Skipton, Terang, Timboon	54.6%	17:45
Glenelg Shire	3	Casterton, Heywood, Portland	72.5%	13:49
Greater Geelong	8	Bellarine, Belmont, Geelong, Lara, Leopold, Norlane, Ocean Grove, Swan Bay	79.6%	12:00
Moyne Shire	3	HEMS4, Mortlake, Port Fairy	39.6%	18:14
Queenscliffe Borough	0	Nil	54.1%	15:05
Southern Grampians Shire	5	Balmoral, Coleraine, Glenthompson, Hamilton, Peshurt	58.5%	17:55
Surf Coast Shire	4	Anglesea, Lorne, Torquay, Winchelsea	59.9%	15:32
Warrnambool City	1	Warrnambool	93.0%	10:05
Total	33			

7.8.2 Police Stations

There are 43 police stations across the region as follows:

Table 29. Police Stations in BSWR by LGA¹⁷⁴

LGA	No. Stations	Locations
Colac Otway Shire	7	Apollo Bay, Beeac, Birregurra, Colac, Cressy, Forrest Hill, Lavers Hill
Corangamite Shire	7	Camperdown, Cobden, Lismore, Port Campbell, Skipton, Terang, Timboon
Glenelg Shire	5	Casterton, Dartmoor, Heywood, Merino, Portland
Greater Geelong	7	Bellarine, Corio, Drysdale, Geelong, Lara, Portarlington, Waurn Ponds
Moyne Shire	4	Koroit, Macarthur, Mortlake, Port Fairy
Queenscliffe Borough	1	Queenscliffe
Southern Grampians Shire	7	Balmoral, Branxholme, Cavendish, Coleraine, Dunkeld, Hamilton, Peshurst
Surf Coast Shire	4	Anglesea, Lorne, Torquay, Winchelsea
Warrnambool City	1	Warrnambool
Total	43	

¹⁷³ <https://www.ambulance.vic.gov.au/about-us/our-performance/>

¹⁷⁴ Data Vic (2020): <https://discover.data.vic.gov.au/dataset/foi-point-vicmap-features-of-interest>

7.8.3 Fire stations, lookouts and refuges

There are 241 fire stations across the region, as well as 6 CFA forest industry brigades, as outlined below:

Table 30. Fire stations in BSWR by LGA¹⁷⁵

LGA	No. Stations (and Brigades)	Locations
Colac Otway Shire	29 (2 Forest Industry Brigades)	Akd-Calco CFA Forest Industry Brigade Apollo Bay Fire Station Barongarook West Fire Station Barwon Downs Fire Station Beeac Fire Station Birregurra Fire Station Bungador Fire Station Carlisle River Fire Station Colac Fire Station Cororooke Fire Station Cressy Fire Station Dreeite South Fire Station Forrest Fire Station Gellibrand Fire Station Gerangamete Fire Station Hvp Otways Plantations CFA Forest Industry Brigade Irrewarra Fire Station Irrewillipe Fire Station Kawarren Fire Station Larpent Fire Station Nalangil Fire Station Otway Fire Station Stonyford Fire Station Swan Marsh Fire Station Warrion Fire Station Weering-Eurack Fire Station Wye River Fire Station Yeo District Fire Station Yeodene Fire Station
Corangamite Shire	34	Berrybank Fire Station Bookaar Fire Station Boorcan Fire Station Bostocks Creek Fire Station Brucknell-Ayrford Fire Station

¹⁷⁵ Data Vic (2020): <https://discover.data.vic.gov.au/dataset/foi-point-vicmap-features-of-interest>

LGA	No. Stations (and Brigades)	Locations
		Camperdown Fire Station Carpendeit-Sth Purrumbete Fire Station Chocolyn Fire Station Cobden Fire Station Cobrico Fire Station Darlington Fire Station Derrinallum Fire Station Dixie Fire Station Duverney Fire Station Ecklin District Fire Station Elingamite - Glenfyne Fire Station Jancourt Fire Station Kennedys Creek Fire Station Leslie Manor Fire Station Lismore Fire Station Lower Heytesbury Fire Station Mingay District Fire Station Noorat District Fire Station Pomborneit Dist Fire Station Port Campbell Fire Station Princetown Fire Station Scotts Ck-Cowleys Ck. Fire Station Simpson Fire Station Skipton Fire Station Terang Fire Station Tesbury Fire Station Timboon Fire Station Vite Vite North Fire Station Weerite Fire Station
Glenelg Shire	43 (1 Forest Industry Brigade)	Bahgallah Fire Station Cape Bridgewater Fire Station Cashmore Fire Station Casterton Fire Station Condah Fire Station Corndale Fire Station Dartmoor Fire Station Digby Fire Station Drik Drik Fire Station Drumborg Fire Station Dunrobin Nangeela Fire Station

LGA	No. Stations (and Brigades)	Locations
		Dunrobin Nangeela Satellite Fire Station (Dunrobin) Glenorchy Estate Fire Station Gorae West Fire Station Gorae West Satellite Fire Station (Mount Richmond) Gpfl CFA Forest Industry Brigade Grassdale Fire Station Heathmere Fire Station Henty Fire Station Heywood Fire Station Homerton Fire Station Hotspur Fire Station Killara Fire Station Lake Mundi Fire Station Lindsay Fire Station Lyons Fire Station Merino Fire Station Milltown Fire Station Morven Fire Station Mumbannar Fire Station Myamyn Fire Station Narrawong Fire Station Nelson Fire Station Paschendale Fire Station Portland Fire Station Sandford Fire Station Strathdownie Fire Station Tahara Fire Station Tahara Satellite Fire Station (Tahara West) Tyrendarra Fire Station Wallacedale Fire Station Wando Bridge Fire Station Wando Vale Fire Station
Greater Geelong	21 (2 Forest Industry Brigades)	Anakie Fire Station Barrabool Fire Station Barwon Heads Fire Station Belmont Fire Station Corio Fire Station Drysdale Fire Station Geelong City Fire Station Geelong West Fire Station

LGA	No. Stations (and Brigades)	Locations
		Grovedale Fire Station Highton Fire Station Lara Fire Station Leopold Fire Station Lovely Banks Fire Station Malec Bros. CFA Forest Industry Brigade Mannerim Fire Station Midway Otways CFA Forest Industry Brigade Ocean Grove Fire Station Portarlington Fire Station St Leonards-Indented Head Fire Station Stonehaven Fire Station Wallington Fire Station
Moyne Shire	46	Abbey Hills Fire Station Ardonachie Fire Station Bessiebelle Fire Station Broadwater Fire Station Caramut Fire Station Chatsworth Fire Station Codrington Fire Station Cudgee Fire Station Dundonnell Fire Station Ellerslie Fire Station Framlingham Fire Station Garvoc Fire Station Grassmere Fire Station Hawkesdale Fire Station Hexham Fire Station Kirkstall Fire Station Knebsworth Fire Station Kolora Fire Station Koroit Fire Station Laang Fire Station Macarthur Fire Station Mepunga Fire Station Minhamite Fire Station Mortlake Fire Station Naringal Fire Station Nirranda South Fire Station Nullawarre Fire Station

LGA	No. Stations (and Brigades)	Locations
		Orford Fire Station Panmure Fire Station Peterborough Fire Station Port Fairy Fire Station Purnim Fire Station Ripponhurst Fire Station Spring Creek Fire Station St Helens Fire Station The Sisters Fire Station Toolong Fire Station Wangoom Fire Station Warrong Fire Station Willatook District Fire Station Winslow Yarrpturk Fire Station Winslow Yarrpturk Satellite Fire Station (Mailors Flat) Woolsthorpe Fire Station Wooriwyrite Fire Station Woorndoo Fire Station Yambuk Fire Station
Queenscliffe Borough	2	Queenscliff Fire Station Queenscliff Satellite Fire Station (Point Lonsdale)
Southern Grampians Shire	51 (2 Forest Industry Brigades)	Ardachy Fire Station Austgum CFA Forest Industry Brigade Bainbridge Fire Station Balmoral Fire Station Bochara Fire Station Branxholme Fire Station Brimpaen Satellite Fire Station (Glenisla) Buckley Swamp Fire Station Bulart Fire Station Burn Brae Fire Station Byaduk Fire Station Carapook Fire Station Cavendish Fire Station Coleraine Fire Station Croxton East Fire Station Culla Fire Station Dunkeld Fire Station Gazette Fire Station Glenthompson Fire Station

LGA	No. Stations (and Brigades)	Locations
		Grange Fire Station Gringe Fire Station Gritjurk Fire Station Hamilton Fire Station Hensley Park Fire Station Hilgay Settlers Fire Station Karabeal Fire Station Konongwootong Fire Station Linlithgow Fire Station Melville Forest Fire Station Mirranatwa Fire Station Mooralla Fire Station Muntham Fire Station Nareen Fire Station North Balmoral Fire Station North Byaduk Fire Station North Hamilton Fire Station Penshurst Fire Station Pf Olsen CFA Forest Industry Brigade Pigeon Ponds Fire Station Strathkellar Fire Station Strathmore Fire Station Tarrayoukyan Fire Station Tarrenlea Fire Station Tarrington Fire Station Vasey Fire Station Victoria Valley Fire Station Wando Heights Fire Station Warrayure-Moutajup Fire Station Woodhouse Fire Station Wootong Vale Fire Station Yulecart Fire Station
Surf Coast Shire	12	Aireys Inlet Fire Station Anglesea Fire Station Bellbrae Fire Station Connewarre Fire Station Deans Marsh Fire Station Freshwater Creek Fire Station Gnarwarre Fire Station Lorne Fire Station

LGA	No. Stations (and Brigades)	Locations
		Modewarre Fire Station Torquay Fire Station Winchelsea Fire Station Wurdale Fire Station
Warrnambool City	3	Allansford Fire Station Warrnambool Fire Station Woodford Fire Station
BSWR Total	241	

There are 15 fire lookouts across the region, as below:

Table 31. Fire lookouts in BSWR by LGA¹⁷⁶

LGA	No. Lookouts	Locations
Colac Otway Shire	2	Crowes, Mt Gellibrand
Corangamite Shire	1	Mt Porndon
Glenelg Shire	5	Annya, Balrook, Corndale, Mt Clay, Rennick
Greater Geelong	1	Mt Anakie
Moyne Shire	1	Mt Warrnambool
Queenscliffe Borough	0	Nil
Southern Grampians Shire	3	Mt Bepcha, Mt Dundas, Mt Rouse
Surf Coast Shire	2	Mt Cowley, Peters Hill
Warrnambool City	0	Nil
BSWR Total	15	

There is one Community Fire Refuge in the region, the Lavers Hill Community Fire Refuge located in Colac Otway Shire at the Otway CFA Fire Station.¹⁷⁷

¹⁷⁶ Data Vic (2020): <https://discover.data.vic.gov.au/dataset/foi-point-vicmap-features-of-interest>

¹⁷⁷ CFA (2020): <https://www.cfa.vic.gov.au/plan-prepare/community-fire-refuges>

There are also 53 Neighbourhood Safer Places (NSP), as outlined below:

Table 32. Neighbourhood Safer Places in BSWR by LGA¹⁷⁸

LGA	No. NSPs	Locations
Colac Otway Shire	9	Apollo Bay, Barwon Downs (2), Beeac, Beech Forest, Birregurra, Cressy (2), Gellibrand
Corangamite Shire	5	Derrinallum, Lismore, Port Campbell, Skipton, Timboon
Glenelg Shire	7	Casterton, Dartmoor, Heywood, Merino, Nelson (2), Portland
Greater Geelong	0	Nil
Moyne Shire	5	Hawkesdale, Koroit, Mortlake, Panmure, Peterborough
Queenscliffe Borough	0	Nil
Southern Grampians Shire	9	Balmoral (2), Branxholme, Cavendish, Coleraine, Dunkeld, Glenthompson, Hamilton, Penshurst
Surf Coast Shire	10	Aireys Inlet, Anglesea (2), Deans Marsh, Jan Juc, Lorne (2), Moriac, Mt Moriac, Winchelsea,
Warrnambool City	8	Warrnambool (8)
BSWR Total	53	

7.8.4 SES

There are 23 SES units across the region, including:

Table 33. SES units in BSWR by LGA¹⁷⁹

LGA	No. Units	Locations
Colac Otway Shire	2	Colac, Otway
Corangamite Shire	5	Camperdown, Cobden, Lismore, Port Campbell, Terang
Glenelg Shire	3	Dartmoor, Heywood, Portland
Greater Geelong	4	Bellarine, Corio, Geelong, South Barwon
Moyne Shire	2	Mortlake, Port Fairy
Queenscliffe Borough	0	Nil
Southern Grampians Shire	3	Balmoral, Dunkeld, Hamilton
Surf Coast Shire	3	Lorne, Torquay, Winchelsea
Warrnambool City	1	Warrnambool
BSWR Total	23	

178 CFA (2020): <http://www.saferplaces.cfa.vic.gov.au/cfa/search/default.htm>

179 Data Vic (2020): <https://discover.data.vic.gov.au/dataset/foi-point-vicmap-features-of-interest>

7.8.5 Life Saving Victoria Units

There are 16 LSV Surf Life Saving Clubs (SLSC) in the region, as outlined below:

Table 34. Life Saving Victoria Units in BSWR by LGA¹⁸⁰

LGA	No. Units	Locations
Colac Otway Shire	3	Apollo Bay SLSC Kennett River SLSC Wye River SLSC
Corangamite Shire	1	Port Campbell SLSC
Glenelg Shire	1	Portland SLSC
Greater Geelong	3	Bancoora SLSC Barwon Heads SLSC Ocean Grove SLSC
Moyne Shire	1	Port Fairy SLSC
Queenscliffe Borough	1	Point Lonsdale SLSC
Southern Grampians Shire	0	Nil
Surf Coast Shire	5	Lorne SLSC Fairhaven SLSC Anglesea SLSC Jan Juc SLSC Torquay SLSC
Warrnambool City	1	Warrnambool SLSC
Total	16	

7.8.6 Volunteer Coast Guard

There are four Coast Guard flotillas in the region, as outlined below:¹⁸¹

- VF17 Portland (Glenelg Shire)
- VF8 Geelong
- VF9 Queenscliff
- VF16 Warrnambool

A map of emergency services is provided in Figure 23.

¹⁸⁰ Surf Life Saving Australia (2020): <https://sls.com.au/club-directory/>

¹⁸¹ Australian Volunteer Coastguard (2020): <https://coastguard.com.au/locations/full-flotilla-list/>

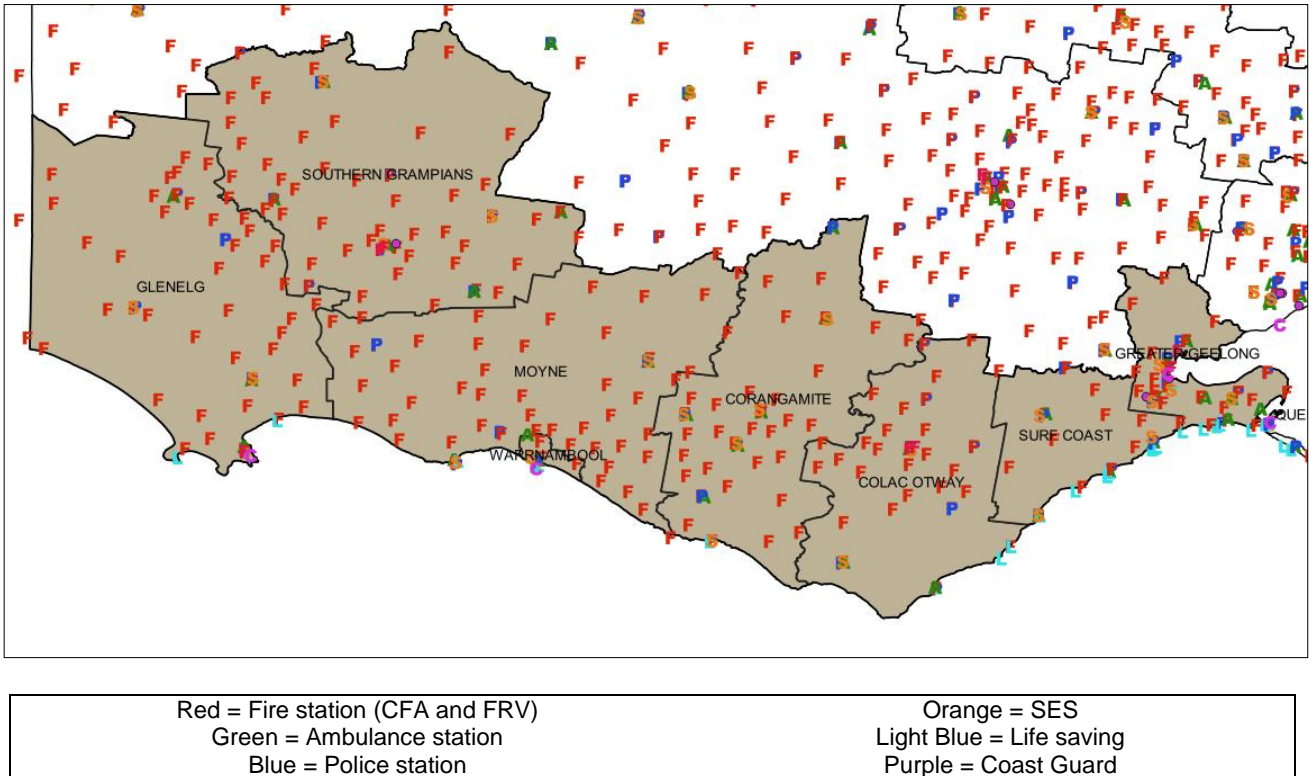


Figure 23. Emergency services for the Barwon South West Region¹⁸²

7.8.7 Emergency Coordination Facilities

Emergency services agencies are supported by the State Control Centre (SCC) in East Melbourne (the State’s primary control centre for the management of Class 1 and Class 2 emergencies), a Regional Control Centre (RCC) in Greater Geelong (a facility that enables the implementation of Command, Control and Coordination arrangements within a set regional boundary) and Incident Control Centres (ICCs) in Colac Otway Shire (Colac), Glenelg Shire (Casterton and Heywood), Greater Geelong (Geelong), Southern Grampians Shire (Hamilton) and Warrnambool City (Warrnambool), where an Incident Controller and Incident Management Teams can manage response activities in an emergency.¹⁸³

In total there are 42 emergency coordination centres across the region, including 34 Local Command Facilities (LCF) and one Marine Rescue Service, as outlined below:

¹⁸² Data Vic (2020): <https://discover.data.vic.gov.au/dataset/foi-point-vicmap-features-of-interest>
¹⁸³ EMV (2019): <https://files-em.em.vic.gov.au/public/Doctrine/ManHand/VIC-EOpsHandbook.pdf>

Table 35. Emergency Coordination Facilities in BSWR by LGA¹⁸⁴

LGA	Facility			Locations (RCC, ICC, LCF)
	RCC	ICC	LCF	
Colac Otway Shire	-	1	2	Colac Apollo Bay, Colac
Corangamite Shire	-	-	3	Cobden, Lismore, Timboon
Glenelg Shire	-	2	8	Casterton, Heywood Casterton, Dartmoor, Digby, Heywood, Lake Mundi, Nelson, Portland, Strathdownie
Greater Geelong	1	1	4	Barwon South West (CFA) Geelong Anakie, Corio, Lara, Wallington
Moyne Shire	-	-	6	Hawkesdale, Macarthur, Mortlake, Naringal, Purnim, Toolong
Queenscliffe Borough	-	-	-	Nil
Southern Grampians Shire	-	1	7	Hamilton Balmoral, Branxholme, Cavendish, Coleraine, Dunkeld, Hamilton, Peshurst
Surf Coast Shire	-	-	4	Anglesea, Lorne, Torquay, Winchelsea
Warrnambool City	-	1	-	Warrnambool
Total	1	6	34	42

A map of emergency coordination facilities is provided in the figure below:

184 <https://discover.data.vic.gov.au/dataset/foi-point-vicmap-features-of-interest>

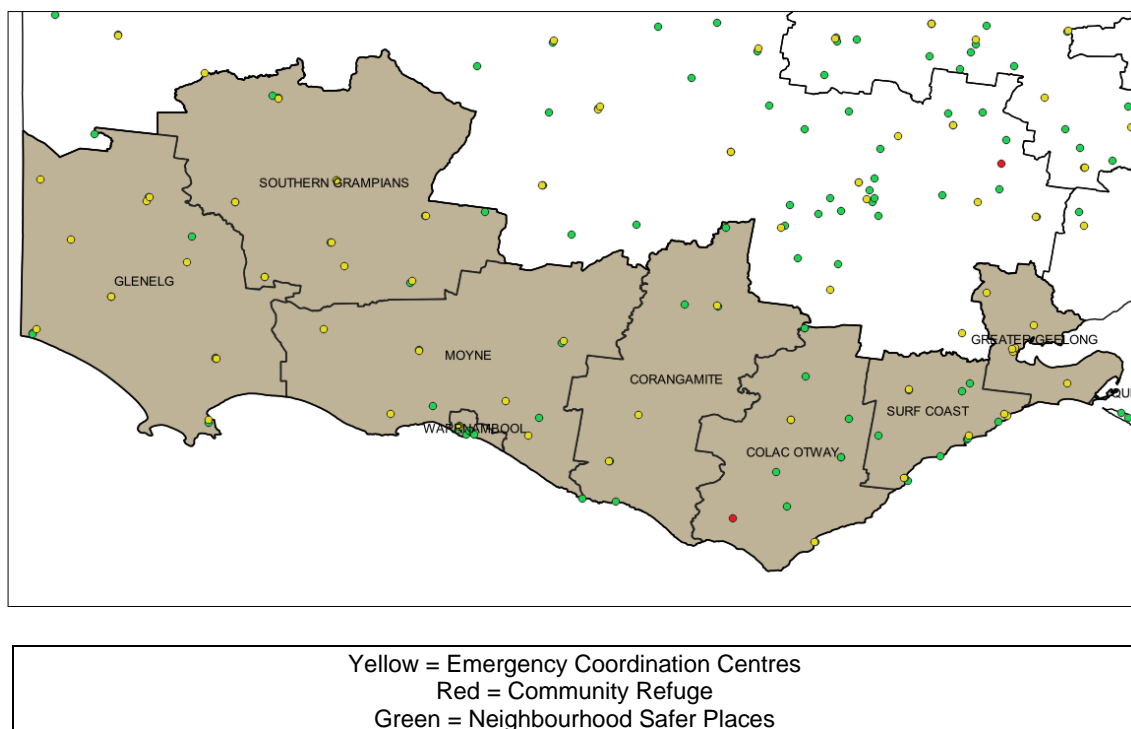


Figure 24. Emergency Coordination facilities, Fire refuges and NSPs for BSWR¹⁸⁵

7.9 Other infrastructure assets and industries

7.9.1 Infrastructure and industries

Barwon South West Region is home to a number of infrastructure assets and industries, including:

- Abattoirs (2)
 - Koallah Farm Abattoir
 - Midfield Meat Group Abattoir
 - Warrnambool Abattoir (Midfield)
- Backpacker Accommodations (5)
 - Port Campbell Hostel
 - Port Fairy THA
 - Star of the West Hostel
 - The 13th Apostle
 - Warrnambool Beach Backpackers
- Rooming Houses (123)

¹⁸⁵ Data Vic (2020): <https://discover.data.vic.gov.au/dataset/foi-point-vicmap-features-of-interest>

- Supported Residential Facilities (7)
- Infrastructure Assets (3)
 - Mortlake Power Station
 - Iona Underground Gas Storage and Power Plant
 - Geelong Fuel Refinery
- Major Hazard Facilities¹⁸⁶ (6)
 - Viva Energy Refining Pty Ltd
 - LyondellBasell Australia Pty Ltd
 - Viva Energy Refining Pty Ltd
 - Lochard Energy (Iona Operations) Pty Ltd
 - BHP Billiton Petroleum Pty Ltd
 - Lattice Energy Limited

7.9.2 Dependencies

The following infrastructure assets are key dependencies for this region:

- Vic/SA electricity interconnector
- Iona-SA gas pipeline
- V-Line from Geelong to Melbourne and Warrnambool, Warrnambool to Melbourne.
- Interstate passenger and freight line between Adelaide/Perth and Melbourne via Ararat and Geelong.
- Freight rail access to Port of Melbourne and Port of Geelong from north (via Ballarat) and west (via Warrnambool and Ararat) via Geelong.
- One of two oil refineries in Victoria is located in Geelong (Viva Energy).
- Princes Freeway/Highway – Melbourne-Geelong-Warrnambool-Portland-Mount Gambier-Adelaide link
- Midland Highway – Geelong-Ballararat-Bendigo-Shepparton-Benalla-Mansfield
- Hamilton Highway – Geelong-Cressy-Mortlake-Hamilton link
- Great Ocean Road – Torquay-Lorne-Apollo Bay-Allansford link

¹⁸⁶ <https://content.api.worksafe.vic.gov.au/sites/default/files/2019-06/ISBN-Licensed-registered-major-hazard-facilities-2019-05.pdf>

- Bellarine Highway – Geelong-Queenscliff-Sorrento (via car ferry) link
- Surf Coast Highway – Geelong-Torquay link
- Hopkins Highway – Warrnambool-Mortlake link
- Glenelg Highway – Ballarat-Skipton-Hamilton-Mount Gambier link
- Henty Highway – Lascelles-Hopetoun-Horsham-Hamilton-Portland link
- Electrical substation connecting Corangamite to Grampians
- Electrical substation connecting Moyne to Greater Geelong (through Grampians)
- Two electrical substation connecting Greater Geelong to Melbourne metros
- One refinery located in Geelong and operated by Viva Energy. It supplies over 50% of Victoria's and 10% of Australia's fuel.
- Rocklands Reservoir, the largest reservoir within Grampians-Wimmera-Mallee Water (GMMW), supplies the Loddon Mallee.
- Melbourne - Geelong Water connection
- Moorabool Water Treatment Plant

7.9.3 Tourism infrastructure

Other significant infrastructure includes sites such as event facilities and stadiums, major tourist attractions and shopping centres. These sites are outlined below:

Table 36. Tourism infrastructure in BSWR by LGA¹⁸⁷

LGA	Infrastructure Category	Name
Colac Otway Shire	Event facility	Colac Otway Performing Arts and Cultural Centre Colac Turf Club
Corangamite Shire		
Glenelg Shire		
Greater Geelong	Shopping centre Event and Entertainment facilities	Westfield Geelong Shopping Centre Market Square Shopping Centre Kardinia Park (GMHBA Stadium) Geelong Arena Geelong Motor Sports Complex Geelong Racecourse Geelong Showgrounds Beckley Park Avalon Raceway Adventure Park Geelong Performing Arts Centre Bellarine Railway Barwon Valley Activity Centre The Potato Shed Barwon Valley Fun Park Jirrahlinga Koala and Wildlife Sanctuary
Moyne Shire		
Queenscliffe Borough		
Southern Grampians Shire		
Surf Coast Shire	Event and Entertainment facilities	Barwon Park Mansion
Warrnambool City	Shopping Centre Event and Entertainment facilities	Armada Gateway Plaza Shopping Centre Northpoint Shopping Centre Lighthouse Theatre Warrnambool Stadium AquaZone

¹⁸⁷ <https://profile.id.com.au/>

7.9.4 Cladding fire safety risk

The Victorian Building Authority (VBA) is in the process of conducting a State-wide audit of non-compliant building materials in Victoria, with a focus on reducing fire safety risks for buildings found to have combustible cladding.¹⁸⁸

- On 25 November 2014, a fire in the 23-storey Lacrosse high-rise building in Docklands highlighted the fire safety risks of non-compliant external wall coverings. The fire, which spread vertically, directly affected approximately 500 residents who required immediate evacuation and accommodation.¹⁸⁹

To date, more than 2,200 inspections have been undertaken and Barwon South West has been identified to have 32 privately owned buildings with cladding. Refer Figure 25.

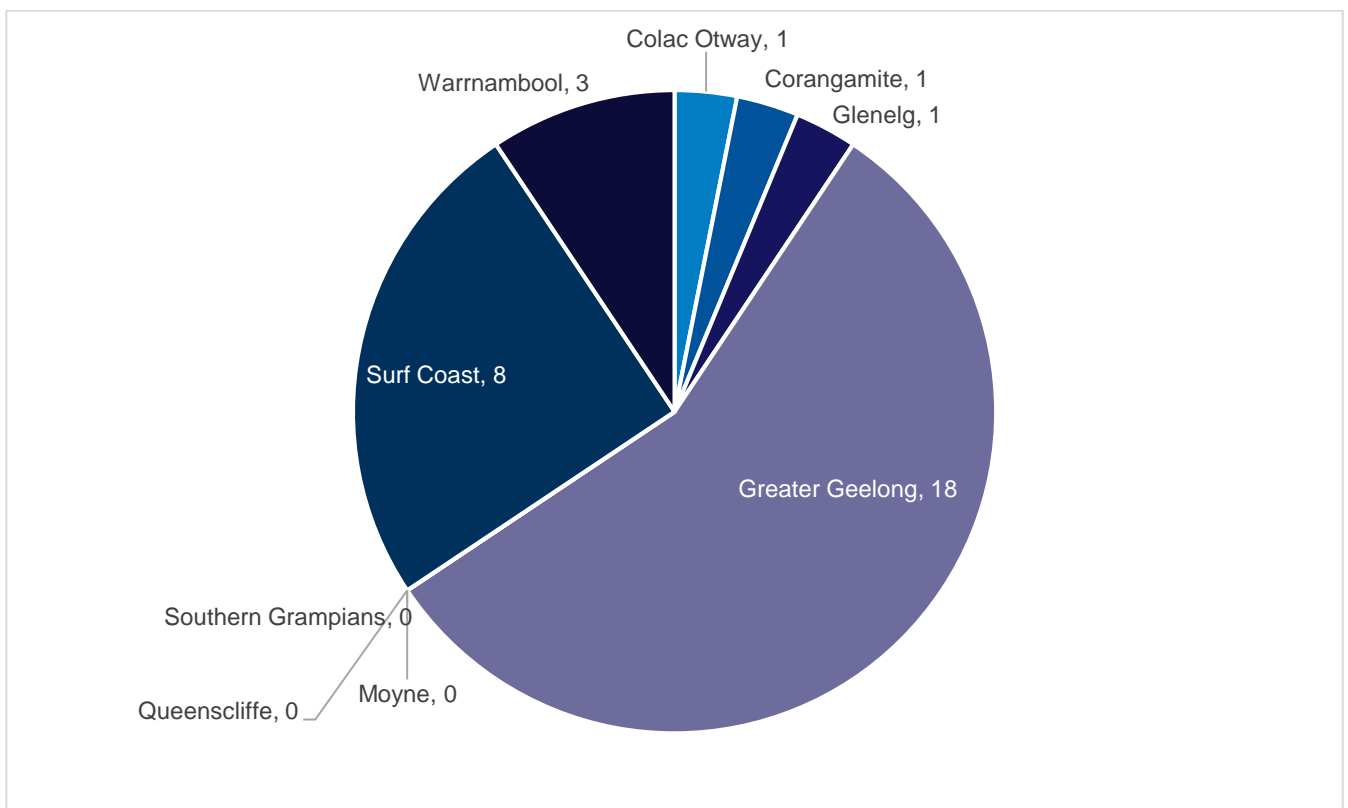


Figure 25. Number of privately owned buildings with cladding by LGA¹⁹⁰

¹⁸⁸ <https://www.vba.vic.gov.au/cladding/audit>

¹⁸⁹ <https://www.melbourne.vic.gov.au/sitecollectiondocuments/mbs-report-lacrosse-fire.pdf>

¹⁹⁰ <https://www.vba.vic.gov.au/cladding/cladding-by-municipality>

8. Social Environment

Social factors that influence the culture and institutions of Barwon South West Region include demographic characteristics and trends, and the values, norms and customs of the people who reside or work within or travel through the region.

8.1 Population

8.1.1 Current population

Over 420,000 people live in the Barwon South West Region, with the majority of the population (62%) living in Greater Geelong.

Population density for BSWR ranged between 2.4 persons per km² (Southern Grampians) and 326.7 persons per km² (Queenscliffe), with an average of 14.4 persons per km².

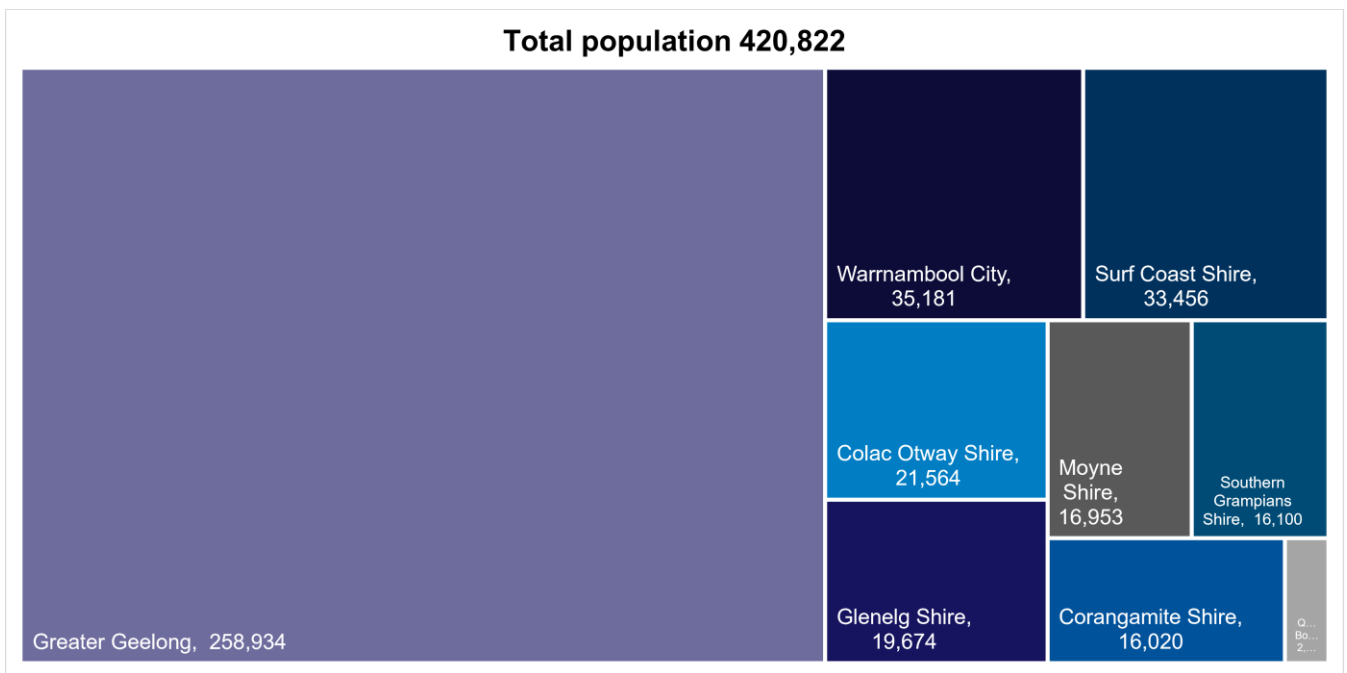


Figure 26. Barwon South West Region Population by LGA (2019) ¹⁹¹

¹⁹¹ ABS (2020): <https://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/3218.02018-19?OpenDocument>

Table 37. BSWR Population Density by LGA (2019)¹⁹²

LGA	Total Population	Area (sq km)	Population Density (persons/km ²)
Colac-Otway	21,564	3,438	6.7
Corangamite	16,020	4,408	3.6
Glenelg	19,674	6,219	3.2
Greater Geelong	258,934	1,248	207.5
Moyne	16,953	5,482	3.1
Queenscliffe	2,940	9	326.7
Southern Grampians	16,100	6,654	2.4
Surf Coast	33,456	1,553	21.5
Warrnambool	35,181	121	290.7
BSWR	420,822	29,132	14.4

8.1.2 Population forecast

By 2036, the population of the region is forecast to increase by 117,944 people (28%) to 538,816 people, with the majority taking up residence in Greater Geelong (+101,311 people) and Surf Coast Shire (+11,982 people). The LGAs of Corangamite Shire, Glenelg Shire and Southern Grampians Shire are forecast to experience declines in population by 2036.

Refer to the below tables and visualisations for Local Government population breakdowns and forecasts.

Table 38. Estimated Population and Projections for BSWR by LGA

LGA	Estimated Population and Projections			
	2019 ¹⁹³	2036 ¹⁹⁴	No. Increase	% Growth
Colac-Otway	21,564	22,330	766	3.6%
Corangamite	16,020	14,892	-1,128	-7.1%
Glenelg	19,674	18,757	-917	-4.7%
Greater Geelong	258,934	360,245	101,311	39.1%
Moyne	16,953	19,026	2,073	12.2%
Queenscliffe	2,940	3,168	228	7.8%
Southern Grampians	16,100	15,029	-1,071	-6.6%
Surf Coast	33,456	45,438	11,982	35.8%
Warrnambool	35,181	39,931	4,750	13.5%
BSWR Total	420,822	538,816	117,994	28.0%
VICTORIA	6,596,039	8,722,766	2,126,727	32.2%

192 DJPR (2020): <https://www.rdv.vic.gov.au/information-portal/table-and-chart>

193 ABS (2017): <https://www.rdv.vic.gov.au/information-portal/table-and-chart>

194 VIF2019 projections: <https://www.planning.vic.gov.au/land-use-and-population-research/victoria-in-future/tab-pages/victoria-in-future-data-tables>

Table 39. BSW Population by LGA and age group (2017)

LGA	Age Group (Years)												Total No.
	0-14	15-19	0-19 Subtotal	20-24	25-34	35-44	45-54	55-64	65-74	75-84	85+	65+ Subtotal	
Colac-Otway	3,858	1,220	5,078	1,177	2,356	2,327	2,835	3,136	2,515	1,369	569	4,453	21,362
Corangamite	3,048	1,049	4,097	804	1,433	1,684	2,322	2,372	1,935	1,150	446	3,531	16,243
Glenelg	3,313	1,225	4,538	974	1,766	2,189	2,969	3,113	2,379	1,291	540	4,210	19,759
Greater Geelong	44,123	14,934	59,057	16,810	31,666	29,926	30,257	28,970	23,366	13,116	6,361	42,843	239,529
Moyne	3,475	992	4,467	781	1,648	2,024	2,373	2,455	1,791	831	367	2,989	16,737
Queenscliffe	356	138	494	85	152	228	335	490	613	378	154	1,145	2,929
Southern Grampians	2,870	1,022	3,892	784	1,532	1,701	2,189	2,386	1,944	1,092	603	3,639	16,123
Surf Coast	6,326	1,694	8,020	1,340	3,243	4,286	4,291	4,155	3,212	1,373	545	5,130	30,465
Warrnambool	6,357	2,283	8,640	2,366	4,281	4,002	4,473	4,208	3,316	1,968	988	6,272	34,242
BSWR	73,726	24,557	98,283	25,121	48,077	48,367	52,044	51,285	41,071	22,568	10,573	74,212	397,389
%	18.6%	6.2%	24.7%	6.3%	12.1%	12.2%	13.1%	12.9%	10.3%	5.7%	2.7%	18.7%	100.0%
VICTORIA	1,166,502	374,125	1,540,627	466,102	991,712	849,923	809,781	705,704	532,826	294,754	130,219	957,799	6,321,648
%	18.5%	5.9%	24.4%	7.4%	15.7%	13.4%	12.8%	11.2%	8.4%	4.7%	2.1%	15.2%	100.0%

Table 40. Projected population for BSWR by LGA and age group (2036)

LGA	Age Group (Years)												Total No.
	0-14	15-19	0-19 Subtotal	20-24	25-34	35-44	45-54	55-64	65-74	75-84	85+	65+ Subtotal	
Colac-Otway	3,434	1,099	4,533	1,057	2,384	2,628	2,594	2,620	3,104	2,506	904	6,514	22,330
Corangamite	2,106	682	2,788	552	1,398	1,686	1,545	1,845	2,481	1,882	716	5,079	14,892
Glenelg	2,643	868	3,510	750	1,532	1,908	1,886	2,474	3,135	2,456	1,106	6,697	18,757
Greater Geelong	61,938	21,099	83,037	23,439	44,279	48,122	44,888	37,988	37,283	28,557	12,652	78,492	360,245
Moyne	3,191	1,033	4,225	920	2,180	2,307	2,392	2,345	2,306	1,698	653	4,658	19,026
Queenscliffe	378	123	501	85	203	256	284	378	606	572	281	1,460	3,168
Southern Grampians	2,230	854	3,085	656	1,286	1,534	1,781	1,832	2,145	1,802	908	4,855	15,029
Surf Coast	7,399	2,467	9,866	2,264	4,537	5,523	6,128	5,733	5,720	4,128	1,540	11,387	45,438
Warrnambool	6,815	2,491	9,306	2,362	4,408	4,728	4,755	4,375	4,671	3,649	1,677	9,997	39,931
BSWR Total	90,135	30,717	120,851	32,085	62,207	68,690	66,253	59,589	61,452	47,251	20,437	129,140	538,816
%	16.7%	5.7%	22.4%	5.9%	11.6%	12.7%	12.3%	11.1%	11.4%	8.8%	3.8%	24.0%	100.0%
VICTORIA	1,484,771	511,324	1,996,095	585,796	1,232,559	1,266,034	1,146,896	886,495	771,700	568,029	269,162	2,948,620	8,722,766
%	17.0%	5.9%	22.9%	6.7%	14.1%	14.5%	13.1%	10.2%	8.8%	6.5%	3.1%	33.8%	100.0%

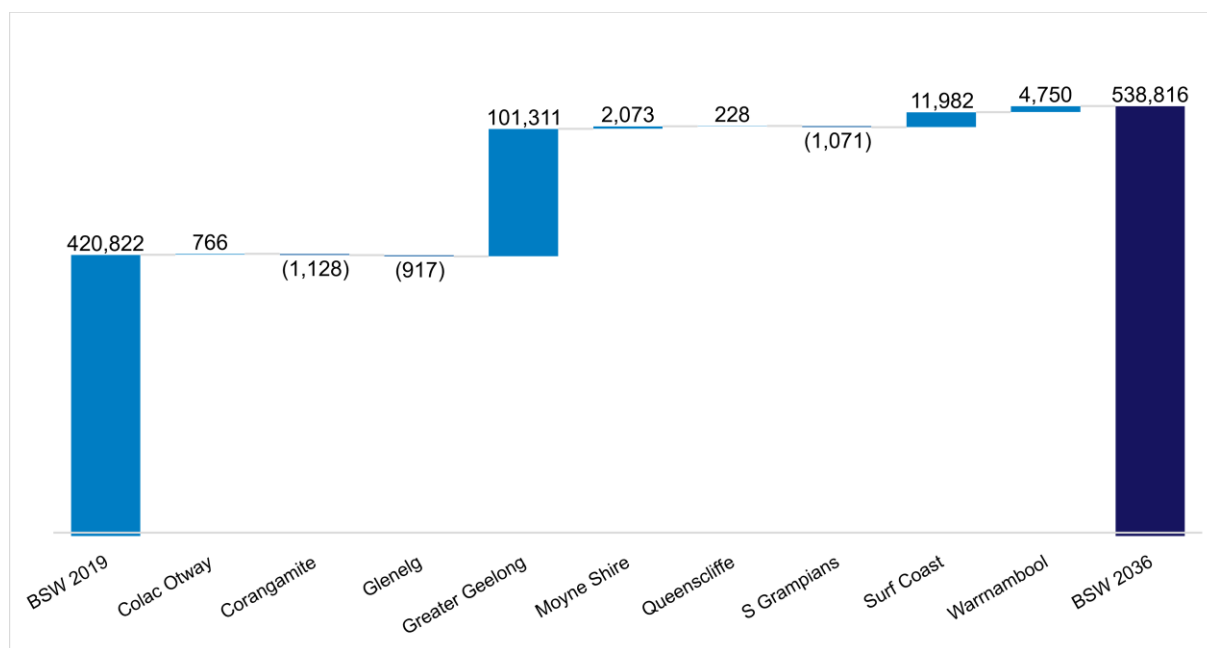


Figure 27. Population growth for BSWR by LGA (2019-2036) ¹⁹⁵

8.2 Vulnerability indicators

In emergency management there are many population vulnerability indicators that have a geographical distribution and are relevant to natural hazard risk analysis. These include:

- The young, the elderly and those needing assistance, who may be dependent on others for care;
- Single parents, who may lack support for their dependent children;
- Income and public housing residency, which are indicators of socio-economic disadvantage and can have an impact on a household's ability to recover from a disaster;
- Education level and proficiency in English, which can limit understanding of warnings, risks and preparation advice;
- Car ownership, which may have an impact on a household's ability to evacuate;
- Unoccupied dwellings, which may reduce owners' engagement levels with the local community and reduce the likelihood that relevant preparations will be undertaken for their properties.¹⁹⁶

Some of these indicators for BSWR are summarised in Figure 28 and Figure 29. Of note, more than a quarter (26%) of Hume Region households were lone person and fewer than 20% of households (18%) indicated they had no internet connection at home in 2016.

¹⁹⁵ DJPR (2020): <https://www.rdv.vic.gov.au/information-portal/regional-snapshot>

¹⁹⁶ Inspector General for Emergency Management (2019): Review of emergency management for high-risk Victorian communities.

Figure 28. Vulnerable Communities Indicators by LGA (2016)¹⁹⁷

LGA	Vulnerability Indicators (%)						
	Population aged 65+	Lone person households	People with a disability	People with poor English proficiency	Estimated homeless population	Population with no motor vehicles	Population with no internet connection at home
Colac-Otway	21.7%	28.0%	6.4%	0.7%	0.3%	3.7%	21.9%
Corangamite	22.7%	26.7%	5.7%	0.1%	0.3%	3.5%	22.0%
Glenelg	22.1%	28.3%	6.7%	0.3%	0.2%	3.6%	21.4%
Greater Geelong	18.6%	25.0%	6.0%	1.7%	0.3%	5.2%	15.8%
Moyne	18.6%	22.1%	4.5%	0.2%	0.1%	2.2%	18.0%
Queenscliffe	40.6%	31.0%	4.7%	0.6%	0.2%	1.8%	13.9%
Southern Grampians	23.4%	29.2%	5.6%	0.3%	0.1%	4.4%	21.2%
Surf Coast	17.5%	18.8%	3.6%	0.3%	0.2%	1.4%	9.9%
Warrnambool	18.9%	26.5%	5.5%	1.1%	0.4%	5.0%	17.9%
BSW	22.7%	26.0%	5.4%	0.6%	0.2%	3.4%	18.0%

¹⁹⁷ <https://blog.id.com.au/2020/population/demographic-trends/interactive-chart-is-your-community-demographically-vulnerable/#chart>

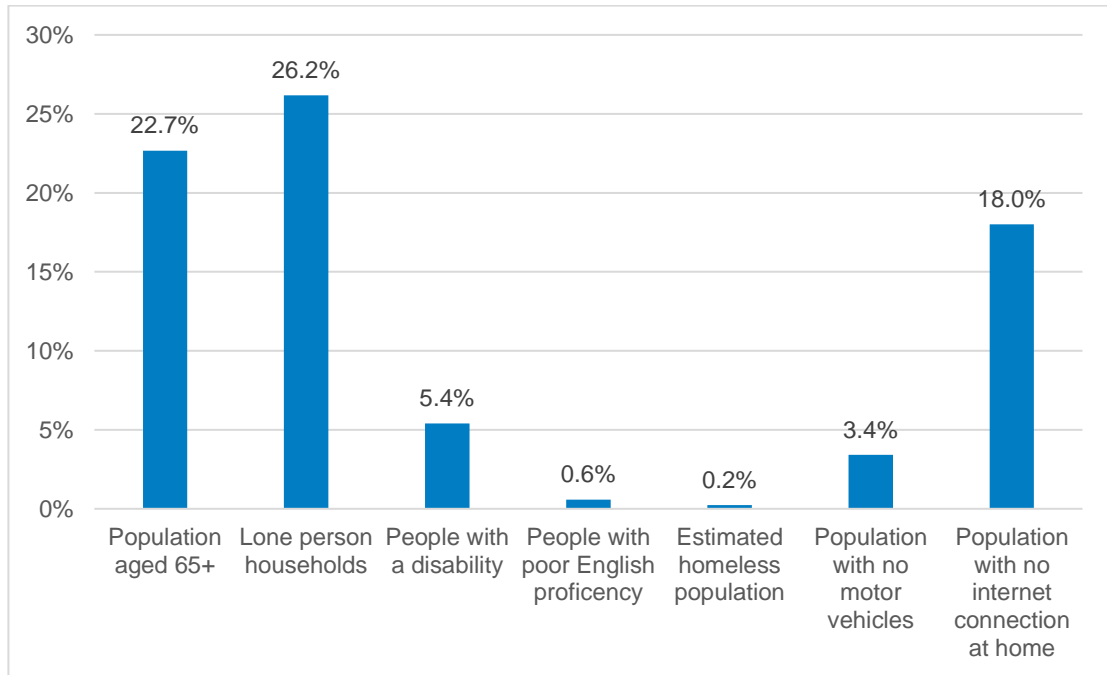


Figure 29. Vulnerable Communities Indicators for BSW (2016)¹⁹⁸

8.2.1 The young and the elderly

Within the Barwon South West Region, 24% of the population was aged 19 years or younger in 2018, while 20% was aged 65 years or older.

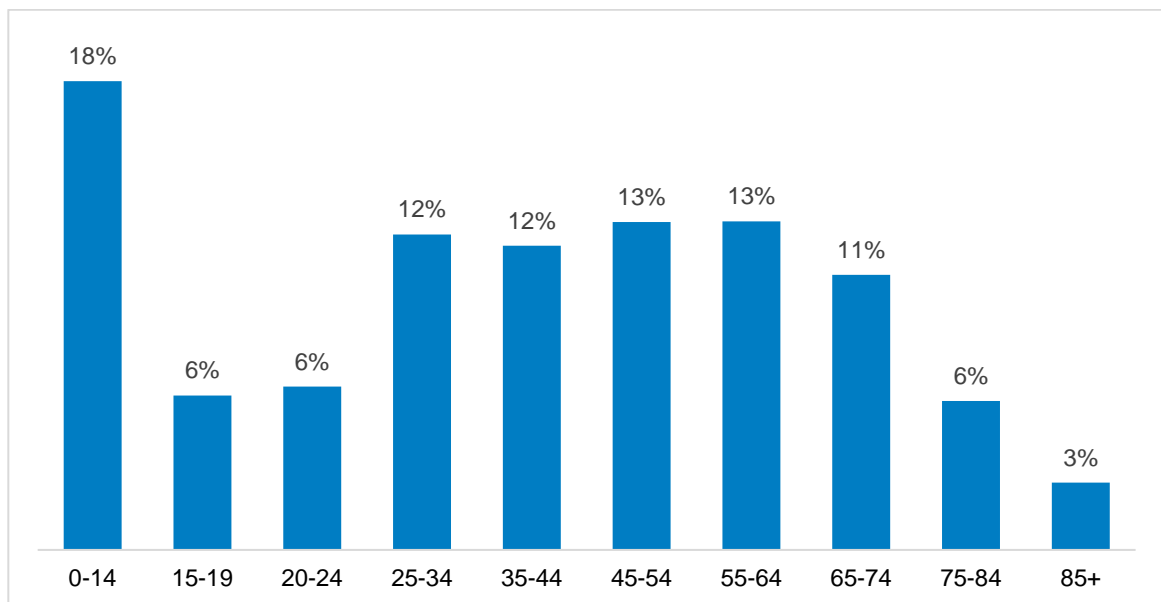


Figure 30. Population breakdown by Age (2018)¹⁹⁹

¹⁹⁸ <https://blog.id.com.au/2020/population/demographic-trends/interactive-chart-is-your-community-demographically-vulnerable/#chart>

¹⁹⁹ DJPR (2020): <https://www.rdv.vic.gov.au/information-portal/table-and-chart>

However, these vulnerable groups were not evenly distributed across the region: Surf Coast Shire had the highest proportion of people aged 0-19 years (27%) while Queenscliffe Borough (16%) had the equal lowest proportion of people aged 0-19 years. Conversely, Queenscliffe Borough had the highest proportion of people aged 65+ years (41%), while Greater Geelong and Surf Coast Shire had the lowest proportion of people aged 65+ years (18%).

Table 41. Proportion of population by age group and LGA (2018)²⁰⁰

LGA	19 years or younger (%)	65 years + (%)
Colac Otway Shire	24%	22%
Corangamite Shire	24%	23%
Glenelg Shire	22%	23%
Greater Geelong	24%	18%
Moyne Shire	27%	19%
Queenscliffe Borough	16%	41%
Southern Grampians Shire	24%	24%
Surf Coast Shire	26%	18%
Warrnambool City	24%	19%

8.2.2 Those needing assistance

When it comes to assistance with core activities, approximately 6.2% of the population of the Barwon South West Region are in need of assistance, in real terms representing 22,304 people. However, the number of people in need varies according to LGA, from just 3.8% of the population in Surf Coast Shire (1,046 people) in 2016 to 7.4% of the population of Glenelg Shire (1,320 people).

200 DJPR (2020): <https://www.rdv.vic.gov.au/information-portal/table-and-chart>

Table 42. Population of BSWR needing assistance with core activities (2016) ²⁰¹

LGA	Total	Percentage
Colac Otway Shire	1,333	6.9%
Corangamite Shire	919	6.2%
Glenelg Shire	1,320	7.4%
Greater Geelong	14,054	6.5%
Moyne Shire	737	4.9%
Queenscliffe Borough	133	5.1%
Southern Grampians Shire	899	6.0%
Surf Coast Shire	1,046	3.8%
Warrnambool City	1,863	6.0%
Total Barwon South West Region	22,304	6.2%

8.3 Diversity

8.3.1 Birthplaces and languages spoken

Ethnic and cultural indicators reflect a population's composition and can be useful indicators of socio-economic status. These characteristics can help inform decision-makers about a population's ability to access services and information and assist service providers determine the need to communicate in languages other than English.

The population of BSWR is less culturally diverse than metro regions with 13.9% of the population born overseas. The population of Greater Geelong is slightly higher than the rest of BSWR with 17.4% born overseas, while 6.92 % of the population of the Shire of Corangamite were born overseas. Refer to Table 43.

In BSWR the most common countries of birth (other than Australia) were:

- England – which featured in the top three for all LGAs in BSWR
- New Zealand – which also featured in the top three for all LGAs
- Netherlands – which featured in the top three of 4 of the 10 LGAs

More than 7.9% of the population of BSWR speaks a language other than English at home. In all LGAs except for Greater Geelong, the number of people who speak only English at home were above 95%. The

201 DJPR (2020): <https://www.rdv.vic.gov.au/information-portal/table-and-chart>

City of Greater Geelong observed about 88% of the population only speaks English at home. Refer Table 44.

The diversity of most common languages spoken at home other than English is observed to be significant in BSWR with 13 languages listed as common languages to speak at home for the 10 LGAs.

In BSWR the most common languages spoken (other than English) were:

- Italian – which featured in the top three for 6 of the 10 LGAs
- Mandarin – which featured in the top three for 5 of the 10 LGAs
- German – which also featured in the top three for 5 of the 10 LGAs

As a proportion of BSWR, Aboriginal and Torres Strait Islanders represent 1.2% of the total BSWR population, ranging between 0.2% and 0.6% of the population in Queenscliffe Borough and the Surf Coast to 2.7% of the population in the Shire of Glenelg.

There are many Aboriginal languages. However, they do not have geographic boundaries. The most widespread in Victoria are the Kulin languages.²⁰² Refer Figure 31.



Figure 31. Map of Aboriginal languages of Victoria²⁰³

²⁰² <https://www.vcaa.vic.edu.au/Documents/alcv/History.pdf>

²⁰³ <https://cv.vic.gov.au/stories/aboriginal-culture/our-story/vacl-language-map-of-victoria/>

Table 43. BSW Population by Aboriginal and Torres Strait Islander (ATSI) status and birthplace and LGA (2016) ²⁰⁴

LGA	Birthplace						Total	Top 3 Countries of Birth (other than Australia) ²⁰⁵	1	2	3
	Australia				Elsewhere						
	ATSI		All								
	No.	%	No.	%	No.	%					
Colac-Otway	254	1.3%	17,456	90.5%	1,832	9.5%	19,288	100.0%	England	New Zealand	Scotland
Corangamite	151	1.0%	13,539	93.1%	1,007	6.9%	14,546	100.0%	England	New Zealand	Netherlands
Glenelg	476	2.7%	16,174	91.6%	1,479	8.4%	17,653	100.0%	England	New Zealand	Netherlands
Golden Plains	204	1.0%	18,223	90.1%	1,992	9.8%	20,215	100.0%	England	New Zealand	Netherlands
Greater Geelong	2,409	1.1%	179,939	82.6%	37,987	17.4%	217,926	100.0%	England	India	New Zealand
Moyne	191	1.3%	13,840	92.1%	1,187	7.9%	15,027	100.0%	England	New Zealand	Philippines
Queenscliffe	7	0.3%	2,278	89.0%	280	10.9%	2,558	100.0%	England	New Zealand	Scotland
Southern Grampians	244	1.7%	13,520	91.9%	1,187	8.1%	14,707	100.0%	England	New Zealand	Netherlands
Surf Coast	188	0.7%	24,169	87.8%	3,348	12.2%	27,517	100.0%	England	New Zealand	U.S.A
Warrnambool	555	1.8%	28,267	91.2%	2,732	8.8%	30,999	100.0%	England	New Zealand	Taiwan
BSWR Total	4,679	1.2%	327,405	86.1%	53,031	13.9%	380,436	100.0%			

204 ABS Census 2016: <https://www.rdv.vic.gov.au/information-portal/table-and-chart>205 .id (2020): profile.id.com.au

Table 44. BSWR Population by language spoken at home (2016)²⁰⁶

LGA	Language Spoken at Home				Total		Top 3 Languages Spoken (other than English) ²⁰⁷		
	English Only		Other Language				1	2	3
	No.	% BSWR	No.	%	No.	%			
Colac-Otway	18,643	95.5%	885	4.5%	19,528	100.0%	Mandarin	Italian	Arabic
Corangamite	14,518	98.2%	268	1.8%	14,786	100.0%	Dutch	German	Tagalog
Glenelg	17,549	97.5%	443	2.5%	17,992	100.0%	Tagalog	Dutch	German
Golden Plains	19,930	96.8%	649	3.1%	20,579	100.0%	Italian	German	Croatian
Greater Geelong	194,157	88.7%	24,809	11.3%	218,966	100.0%	Italian	Croatian	Mandarin
Moyne	14,894	97.6%	358	2.3%	15,252	100.0%	Mandarin	Filipino	French
Queenscliffe	2,537	96.9%	81	3.1%	2,618	100.0%	Italian	German	Mandarin
Southern Grampians	14,602	97.2%	427	2.8%	15,029	100.0%	Italian	Malayalam	Afrikaans
Surf Coast	26,569	95.7%	1,180	4.2%	27,749	100.0%	German	Italian	French
Warrnambool	29,817	95.3%	1,455	4.6%	31,272	100.0%	Mandarin	Korean	Sinhalese
BSWR Total	353,216	92.0%	30,555	8.0%	383,771	100.0%			

206 ABS (2016): <https://www.rdv.vic.gov.au/information-portal/table-and-chart>207 .id (2020): profile.id.com.au

8.3.2 Income and housing

According to Socio-Economic Indexes for Areas (SEIFA), which measure the relative level of socio-economic advantage or disadvantage based on a range of Census characteristics (where higher scores indicate lower levels of disadvantage), LGAs within the Barwon South West Region were ranked as followed:

Table 45. SEIFA scores and rankings for BSWR by LGA (2016)²⁰⁸

LGA	SEIFA Score	Ranking (Most Disadvantaged)
Colac Otway Shire	961	20th
Corangamite Shire	977	28th
Glenelg Shire	947	12th
Greater Geelong	994	41st
Moyne Shire	1,016	58th
Queenscliffe Borough	1,075	75th
Southern Grampians Shire	992	37th
Surf Coast Shire	1,077	76th
Warrnambool City	986	34th
BSWR Average	1,003	-
VICTORIA Average	997	-

Within BSWR, Glenelg Shire was rated the most disadvantaged (and was the 12th most disadvantaged in Victoria). The Surf Coast Shire was the least disadvantaged, and comparatively across Victoria is the 76th most disadvantaged of 79 Victorian LGAs. Overall, BSWR is less disadvantaged than the average for Victorian LGAs.

Other indicators of socio-economic status include income and housing. In the Barwon South West Region in 2016:

- There were 153,974 occupied private dwellings, with an average of 2.5 persons per dwelling.
- 5.8% of households had no vehicle.

Refer also Table 46.

208 DJPR (2020): <https://www.rdv.vic.gov.au/information-portal/regional-snapshot>

Table 46. Socio-economic indicators for BSWR (2016)²⁰⁹

Indicator	Total	Percentage
Low income households with rental stress	11,107	30.3%
Low income households with mortgage stress	4,264	8.8%
Home ownership	102,607	72.4%
Separate houses		86.5%
Occupied private dwellings	153,974	-
Households with internet connected	116,769	81.9%

These findings provide an indication of the number of properties that could be impacted in the event of an emergency and the relative ease with which people might be able to leave their dwellings by motor vehicle as well. It also indicates the availability of personal financial resources to support any actions required in the event of an emergency.

8.4 Education

8.4.1 Educational institutions

There are 194 schools and 66,969 full-time enrolments in the region, with government schools making up 79% of all schools and 59% of enrolments. Refer Figure 32.

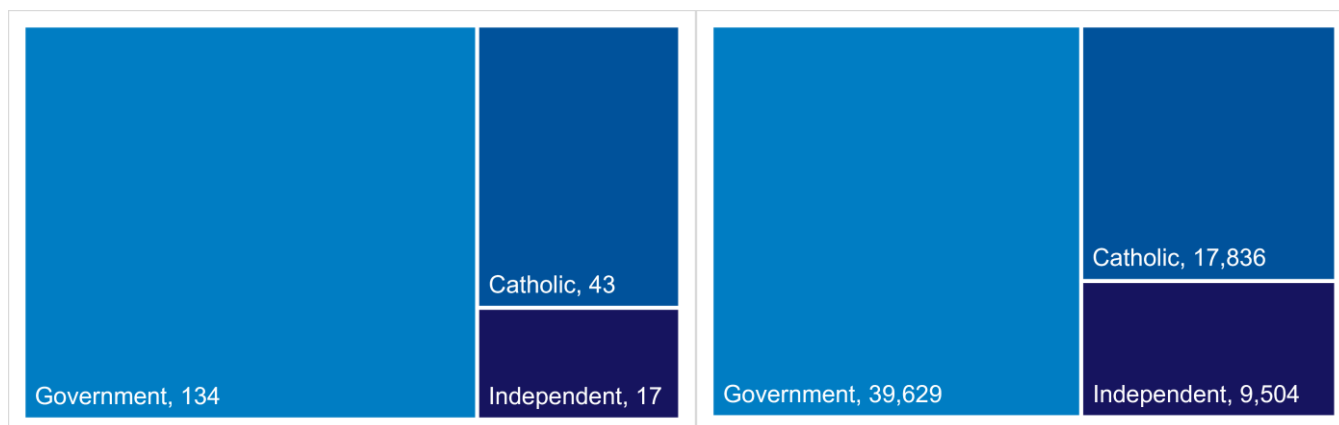


Figure 32. Number and types of schools and full-time enrolments in BSWR (2019)²¹⁰

The number of schools and full-time enrolments in the region are distributed across LGAs as follows, with Greater Geelong having the highest number of schools (83) and the largest number of full-time enrolments (42,729):

209 DJPR (2020): <https://www.rdv.vic.gov.au/information-portal/regional-snapshot>

210 DET (2020): <https://www.education.vic.gov.au/about/department/Pages/factsandfigures.aspx>

Table 47. Schools and full-time enrolments in BSWR by LGA (2019)²¹¹

LGA	No. Schools	Full-time Enrolments
Colac Otway Shire	17	3,291
Corangamite Shire	14	2,617
Glenelg Shire	18	2,615
Greater Geelong	83	42,729
Moyne Shire	13	1,510
Queenscliffe Borough	3	332
Southern Grampians Shire	18	2,957
Surf Coast Shire	13	4,174
Warrnambool City	15	6,744
Total BSWR	194	66,969

There are two universities and two TAFEs with multiple campuses across the region, including:

Table 48. Universities and TAFEs in BSWR²¹²

University/TAFE	Campuses
Deakin University	Geelong – Waterfront and Waurn Ponds Warrnambool
RMIT	Hamilton
The Gordon TAFE	Geelong City and East Geelong
South West Institute of TAFE	Sherwood Park, Hamilton, Portland, Warrnambool and Colac

There are also 315 childcare facilities across the region (including childcare centres, pre-schools and kindergartens).²¹³

Figure 33 shows the location of educational facilities in the Barwon South West Region:

211 <https://www.education.vic.gov.au/about/department/Pages/factsandfigures.aspx>

212 Data Vic (2020): <https://discover.data.vic.gov.au/dataset/foi-point-vicmap-features-of-interest>

213 Data Vic (2020): <https://discover.data.vic.gov.au/dataset/foi-point-vicmap-features-of-interest>

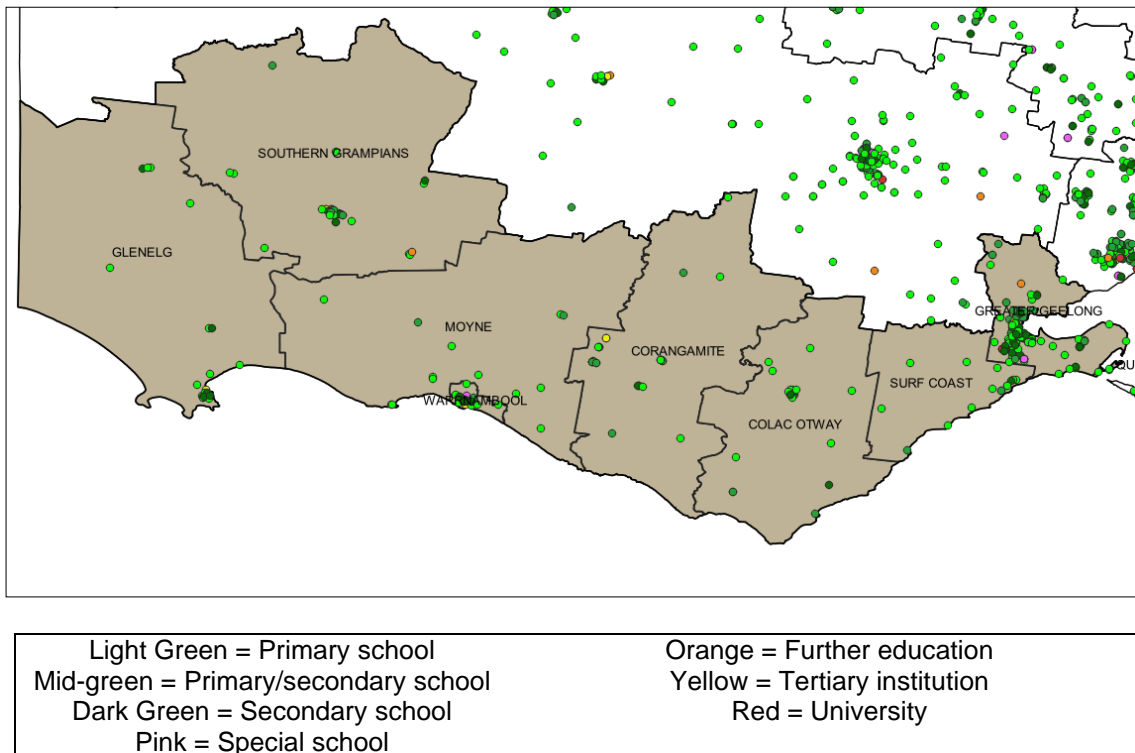


Figure 33. Map of Educational Facilities within the Barwon South West Region²¹⁴

8.4.2 Educational Level

Approximately 1 in 3 persons (36.6%) of people over 15 years of age in the Barwon South West Region have a bachelor’s degree or higher non-school qualification. However, more than 1 in 2 persons (51.7%) did not complete Year 12.

Table 49. Education levels in BSWR (2016)²¹⁵

Education level achieved	Total No.	Percentage
People over 15 with bachelor’s degree or higher non-school qualification	55,672	36.6%
Did not complete Year 12	149,342	51.7%
15-19 years old not in school or employment	1,323	5.5%

8.5 Health

The State Health Emergency Response Plan outlines arrangements for managing health emergencies (i.e., incidents requiring a significant and coordinated response from the health system, the Department of Health and Human Services and the emergency management sector, in partnership with the community) to ensure an effective response and ease adverse consequences.²¹⁶ Practitioners, health professionals, service

214 Data Vic (2020): <https://discover.data.vic.gov.au/dataset/foi-line-vicmap-features-of-interest>

215 DJPR (2020): <https://www.rdv.vic.gov.au/information-portal/table-and-chart>

216 DHHS (2020): <https://www2.health.vic.gov.au/emergencies/shera>

organisations and government agencies may also be required to respond to local emergencies to care for the injured or unwell directly affected.

In 2011, BSWR had 123 general medical practitioners per 100,000 people.²¹⁷

8.5.1 Hospitals and health centres

In an emergency, vulnerable populations such as those in hospitals, health care facilities and retirement villages, may require significant and coordinated priority interventions, responses and support for their safety.

There are 26 hospitals, 3 community health centres and 27 maternal and child health services across the region, as outlined below:

Table 50. Hospitals and Healthcare facilities in BSWR by LGA²¹⁸

LGA	Hospitals	Community Health Centres	Maternal and Child Health Services
Colac Otway Shire	2	0	2
Corangamite Shire	4	0	0
Glenelg Shire	3	2	0
Greater Geelong	8	0	20
Moyne Shire	1	0	0
Queenscliffe Borough	0	0	1
Southern Grampians Shire	3	1	0
Surf Coast Shire	2	0	4
Warrnambool City	3	0	0
Total BSWR	26	3	27

Details of the 26 hospitals across the Barwon South West Region are further outlined below:

²¹⁷ DJPR (2020) <https://www.rdv.vic.gov.au/information-portal/table-and-chart>

²¹⁸ Data Vic (2020): <https://discover.data.vic.gov.au/dataset/foi-point-vicmap-features-of-interest>

Table 51. Hospitals in BSWR by LGA²¹⁹

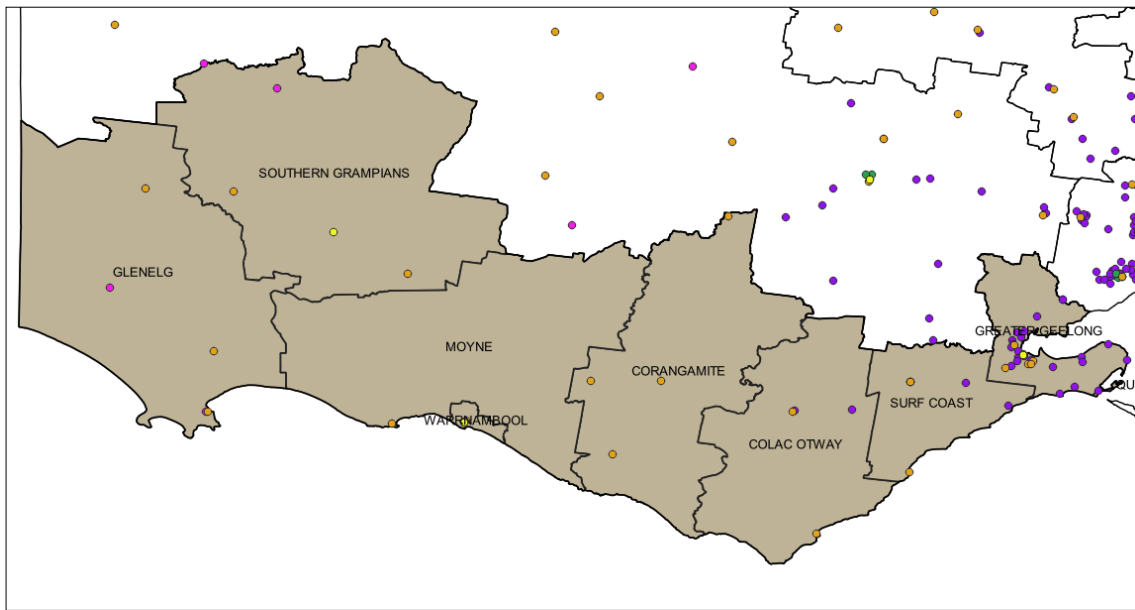
LGA	No. Hospitals	Hospital Names
Colac Otway Shire	2	Apollo Bay Public Hospital Colac Public Hospital
Corangamite Shire	4	Camperdown Public Hospital Skipton Public Hospital Terang Public Hospital Timboon Public Hospital
Glenelg Shire	3	Casterton Public Hospital Heywood Public Hospital Portland Public Hospital
Greater Geelong	8	Epworth Hospital - Geelong Geelong Clinic Geelong Private Hospital Monash IVF Geelong Specialist Geelong St John Of God – Geelong Geelong University Public Hospital Grace Mckellar Centre
Moyne Shire	1	Port Fairy Public Hospital
Queenscliffe Borough	0	Nil
Southern Grampians Shire	3	Coleraine Public Hospital Hamilton Base Public Hospital Penshurst Public Hospital
Surf Coast Shire	2	Lorne Public Hospital Winchelsea Public Hospital
Warrnambool City	3	Epworth South West Regional Cancer Centre St John Of God - Warrnambool Warrnambool Public Hospital
Total BSWR	26	

BSW has three hospitals with Intensive Care Units, with a total of 42 ICU beds available:

- Epworth Hospital – Geelong (6)
- Geelong University Public Hospital (24)
- St John of God – Geelong (12)

Figure 34 shows the location of the above healthcare services, with hospitals centred closer to larger towns, while community health centres are located in more remote areas.

219 DHHS (2017): http://data-dhs.opendata.arcgis.com/datasets/5000b3c446ed419eb590baa3832eb8f7_0



Pink = Community health centre	Orange = General hospital
Purple = Maternal/child health centre	Yellow = General hospital (emergency)
Green = Day procedure centre	

Figure 34. Map of hospitals and health care facilities in the Barwon South West Region²²⁰

8.5.2 Aged Care

There are 82 aged care facilities across the region, as outlined below:

Table 52. Aged Care Facilities in BSWR²²¹

LGA	No. Facilities
Colac Otway Shire	5
Corangamite Shire	10
Glenelg Shire	7
Greater Geelong	36
Moyne Shire	3
Queenscliffe Borough	1
Southern Grampians Shire	7
Surf Coast Shire	7
Warrnambool City	6
Total BSWR	82

The locations of these facilities are also provided below:

220 Data Vic (2020): <https://discover.data.vic.gov.au/dataset/foi-line-vicmap-features-of-interest>
 221 Data Vic (2020): <https://discover.data.vic.gov.au/dataset/foi-point-vicmap-features-of-interest>

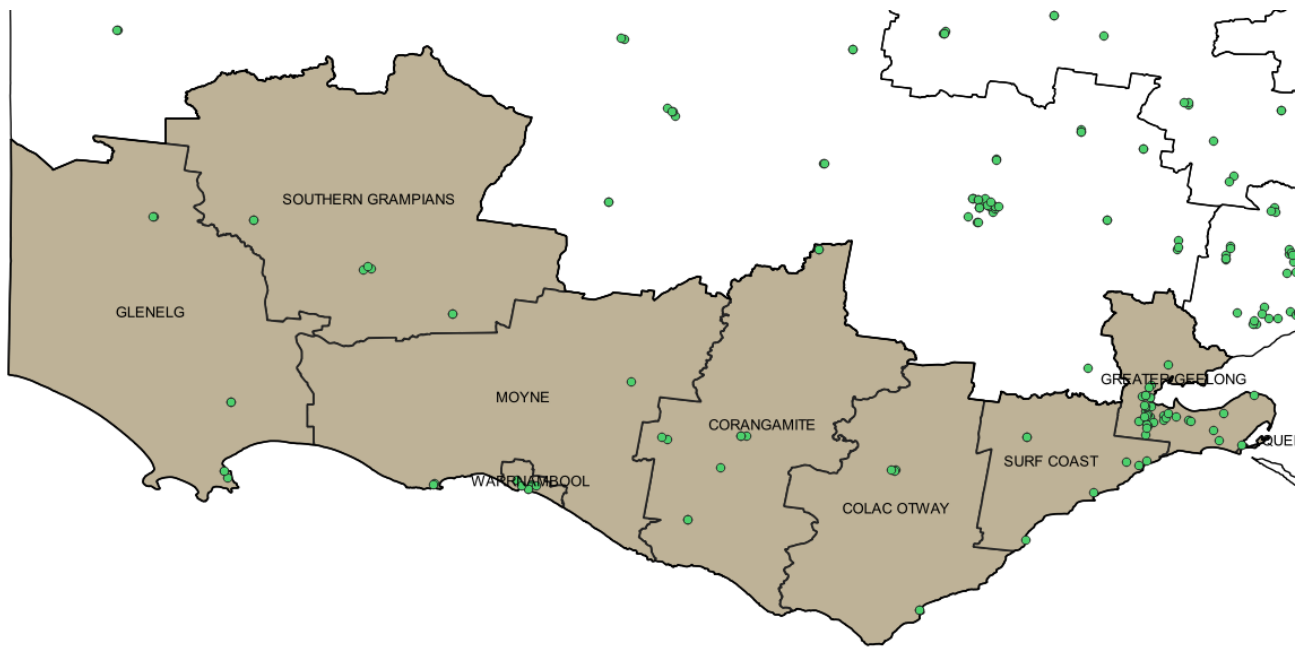


Figure 35. Map of aged care facilities in the Barwon South West Region²²²

The number of people in the Barwon South West Region who accessed aged care support at some stage during the 2018-19 reporting period is outlined in Table 53. This number forms part of the total number of people in the community who may need some form of assistance during an evacuation or emergency.

²²² Data Vic (2020): <https://discover.data.vic.gov.au/dataset/foi-line-vicmap-features-of-interest>

Table 53. Aged Care Support in BSWR (2018-2019) ²²³

Age Bracket	Home Care	Residential Care	Transition Care	Total
0–49	1	10	0	11
50–54	7	14	1	22
55–59	7	37	1	45
60–64	19	60	5	84
65–69	95	161	4	260
70–74	288	251	4	543
75–79	383	426	13	822
80–84	496	742	9	1,247
85–89	482	1,076	22	1,580
90–94	308	1,052	9	1,369
95–99	48	448	5	501
100+	6	61	0	67
Total	2,140	4,339	73	6,552

In 2016, BSWR had 90.6 residential care places per 100,000 population aged 70 years and over. ²²⁴

8.6 Cultural values and assets

The Barwon South West Region includes the traditional lands of the Gunditjmarara, Eastern Maar and Wadawurrung peoples. ²²⁵

The lands of the Eastern Marr people are located in the south, to the south-west of Colac, and continue into the Great South Coast Region. The lands of the Wadawurrung people are in the region's north east, encompassing Greater Geelong and south to Anglesea. ²²⁶

The lands of the Gunditjmarara people stretch from the Victorian and South Australian border in the west to the Yambuk area in the east, from the coast to Casterton in the north. ²²⁷

8.6.1 Aboriginal cultural heritage assets

Important heritage sites in the lands of the Wadawurrung people include the You Yangs Regional Park, an important site for the Wadawurrung people. In 2006, the Wathaurung Aboriginal Co-operative, an organisation supporting Aboriginal and Torres Strait Islander people within the wider Geelong region and

²²³ <https://www.gen-agedcaredata.gov.au/Resources/Access-data/2020/March/GEN-data-People-using-aged-care>

²²⁴ Victorian Health Information Surveillance System (VHISS): <http://vhiss.reporting.dhhs.vic.gov.au/ViewContent.aspx?TopicID=1>

²²⁵ ACHRIS (2020): <https://achris.vic.gov.au/weave/wca.html>

²²⁶ ACHRIS (2020): <https://achris.vic.gov.au/weave/wca.html>

²²⁷ ACHRIS (2020): <https://achris.vic.gov.au/weave/wca.html>

Colac, obtained title to the property known as Wurdi Youang near the foot of the You Yangs. The property contains important natural and cultural heritage and the Co-operative is in consultation to have it listed as an Indigenous Protected Area. A small area of the Eastern Maar people's lands lies within the Barwon region, with significant heritage assets in the Great South Coast region.²²⁸

Important heritage sites in the land of the Eastern Marr people are found in the Grampians National Park, the southern section of which is in the Barwon region. The Grampians, or Gariwerd, are an important place for the Eastern Marr people and other groups, and it plays a central role in their creation story. This area contains a majority of surviving Aboriginal rock art sites in south-east Australia. Traditional food and medicinal plants are still found here. There are multiple ancient middens along the coast. Other important environmental assets include the dry forests along the coastline, the treeless heathlands occurring in a thin section between the Otways forest and the coast, particularly the Carlisle heathlands, and the Red Rock site northwest of Colac. The Eastern Marr people continue to gather food and perform cultural practices on the lands, rivers and coastline, including eeling. Sea Country is extremely important and native title extends 100 metres out from the low tide level to include the Twelve Apostles.²²⁹

The land of the Gunditjmarra people includes many important assets with cultural, economic and heritage values. Key sites include Lake Condah and its surrounding river system, including the World Heritage Listed Budj Bim Cultural Landscape which contains Mount Eccles, Lake Condah Indigenous Protected Area (IPA) and Tyrendarra IPA. This area is listed on the National Heritage List of Australia, providing protection under the *Environment Protection and Biodiversity Conservation Act 1999*. It is an important site with cultural and natural values. It contains a system of weirs and channels constructed from local volcanic rock to manage water flows from Lake Condah and farm eels, which is a rare remaining asset. Budj Bim National Park is co-managed by Gunditjmarra Traditional Owners and Parks Victoria. There are six Gunditjmarra community-owned properties in the Great South Coast region, including three IPAs. The lands of the Gunditjmarra people include the Lower Glenelg, Mount Richmond and Cobboboonee National Parks; Cape Nelson, Dergholm and Mount Napier State Parks; Discovery Bay Marine National Park, and Discovery Bay Coastal Park. These areas hold cultural and economic values and feature in Gunditjmarra creation stories. Aboriginal middens have been found in the Discovery Bay Coastal Park.

Other significant cultural assets in the Barwon South West region include art galleries and museums, as outlined below:

228 Infrastructure Victoria (2019): <https://www.infrastructurevictoria.com.au/wp-content/uploads/2019/04/Aither-Barwon-Regional-Profile-March.2019.pdf>

229 Infrastructure Victoria (2019): <https://www.infrastructurevictoria.com.au/wp-content/uploads/2019/04/Aither-Great-South-Coast-Regional-Profile-March-2019.pdf>

Table 54. Significant cultural assets in BSWR by LGA²³⁰

LGA	Art Galleries and Museums
Colac Otway Shire	Apollo Bay Old Cable Station Museum Colac And District Historical Society Red Rock Regional Theatre and Gallery
Corangamite Shire	Camperdown And District Historical Museum Port Campbell Museum
Glenelg Shire	Bower Bird Nest Museum Casterton Community Museum Portland Cable Trams Portland Maritime Discovery Centre World War Two Memorial Lookout
Greater Geelong	Boom Gallery Drysdale Old Court House Museum Geelong Art Gallery National Wool Museum Old Geelong Gaol
Moyne Shire	Port Fairy History Centre
Queenscliffe Borough	Fort Queenscliff Museum Queenscliffe Historical Museum Queenscliffe Maritime Museum
Southern Grampians Shire	Coleraine Local History Centre and Museum Hamilton Art Gallery Hamilton Pastoral Museum
Surf Coast Shire	Lorne Historical Society Surf World Museum
Warrnambool City	Flagstaff Hill Maritime Museum Warrnambool Art Gallery Warrnambool Historical Society House

The region also hosts a number of major events and festivals throughout the year, including:

²³⁰ Data Vic (2020): <https://discover.data.vic.gov.au/dataset/foi-point-vicmap-features-of-interest>

Table 55. Major Events in BSWR

LGA	Major events and festivals
Colac Otway Shire	Birregurra Festival and Art Show, Otway Oktoberfest at Otway Estate Winery and Brewery, Great Ocean Road Running Festival, Otway Odyssey
Corangamite Shire	Melbourne to Warrnambool Cycling Classic
Glenelg Shire	Tour of the Great South Coast
Greater Geelong	Geelong Royal Show, Australian International Air Show, Festival of Sails, Cadel Evans Great Ocean Road Race, Pako Festa, National Celtic Festival, Portarlington Mussel Festival, Toast to the Coast
Moyne Shire	Port Fairy Folk Festival
Queenscliffe Borough	Queenscliff Music Festival
Southern Grampians Shire	Sheepvention Rural Expo
Surf Coast Shire	Rip Curl Pro
Warrnambool City	Wunta Fiesta, Sungold Field Days

Figure 36 shows two layers that represent areas of cultural and heritage sensitivity. The first in Orange, shows the areas of cultural heritage sensitivity that are known or likely to contain places and objects of significance to Aboriginal cultural heritage. These are defined in the Aboriginal Heritage Regulations 2018 and include areas around designated watercourses and waterways, areas surrounding known Aboriginal cultural heritage places and areas with landforms and soil types that are similar to known cultural heritage places. While the areas shown are more likely to contain a higher number of cultural heritage places and objects, these places can be found all over Victoria where Aboriginal people have lived.²³¹ The areas in blue highlight locations that have been included in the Victorian Heritage Register showing places, objects and shipwrecks that are currently protected under the *Heritage Act 2017*.²³²

231 <https://www.aboriginalvictoria.vic.gov.au/cultural-heritage-sensitivity>

232 <https://vhd.heritagecouncil.vic.gov.au/>

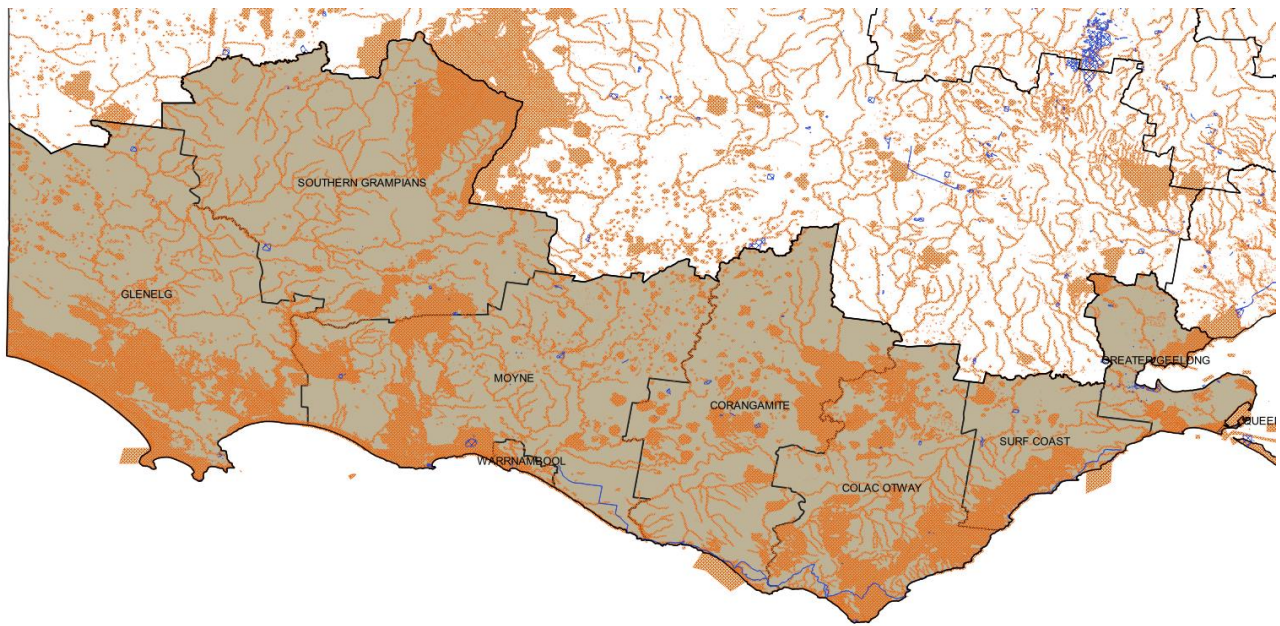


Figure 36. Areas of cultural and heritage significance in BSWR^{233 234}

8.7 Volunteerism

An indication of a region’s level of community volunteering is also an important vulnerability factor because volunteers and their social networks can be of assistance during emergencies. In 2016 in BSWR, 75,501 people (25.9%) indicated they volunteered.²³⁵

According to the Ministerial Council for Volunteers (2017), approximately 4% of volunteers work for an emergency services organisation²³⁶ and EMV estimates over 100,000 people in Victoria volunteer across a wide range of emergency management agencies.²³⁷

- As at 1 July 2020, CFA Victoria noted its volunteer membership at 53,311 people, with an additional 1,486 junior members.²³⁸

Volunteering is evolving in Victoria, particularly with respect to growing expectations around community responsibility for emergency preparedness, the impact on operations of new communications technology, and the characteristics of volunteers. For example, volunteering styles are becoming more diverse, but also more episodic, while physical locations and office hours are becoming less of a constraint to people

233 <https://discover.data.vic.gov.au/dataset/areas-of-cultural-heritage-sensitivity>

234 <https://discover.data.vic.gov.au/dataset/victorian-heritage-register>

235 DJPR (2020) <https://www.rdv.vic.gov.au/information-portal/table-and-chart>

236 Ministerial Council for Volunteers (2017): <https://iepcp.org.au/wp-content/uploads/2018/11/MCV-Volunteers-in-Victoria-report.pdf>

237 EMV (2015): <https://www.emv.vic.gov.au/volunteerstatement>

238 CFA (2020): <https://www.cfa.vic.gov.au/about/cfa-at-a-glance>

volunteering their time and staying connected. However, in their series of reports, Emergency Volunteering 2030,²³⁹ the authors found that:

- Community sector groups anticipate a serious shortage of volunteers in the future, mounting expectations to deliver emergency services, a rise in costs and poorer outcomes for communities.
- Volunteerism managers foresee growing regulation and corporatisation impacting negatively on volunteer sustainability.
- Local government managers have flagged the need to examine how resourcing and funding options and restrictions may be hindering the emergency management sector's ability to respond to the changing landscape of volunteering.

9. Economic Environment

An understanding of the Barwon South West Region's economic resilience can play an important role in emergency management planning by providing some context to how adversity might affect local economies and the degree to which different communities are likely to cope with the ongoing effects of emergencies.

The Barwon sub-region's economy is diverse, with manufacturing and construction being strong contributors alongside service industries such as healthcare. In contrast the Great South Coast sub-region is characterised by a dominant agricultural industry, with agriculture being the key export for the region.

9.1 Economic situation

Agriculture is a substantial economic driver and employer in the Barwon South West region and provides a significant contribution to national agricultural production. The main agricultural industry is dairy across the south with significant forestry in the west and livestock and grains industries in the north. Various commercial, aquaculture industries and recreational fishing activities take place along the coast and in the region's lakes, estuaries and rivers. Manufacturing, retail and healthcare are important contributors to the regional economy, while education institutions also generate employment. The region is also a hub for alternative energy production, with established geothermal, natural gas, wave and wind energy projects in operation.²⁴⁰

New modelling from the Department of Treasury and Finance suggests the coronavirus pandemic has had a potentially unprecedented impact on Victoria's economy. It is likely the State will record negative economic growth for the current and next financial years.

239 DIIS (2019): <https://emergencyvolunteeringau.dropmark.com/594398?q=%23Emergency-Volunteering-2030-study%20%23report>

240 DJPR (2014) https://www.planning.vic.gov.au/__data/assets/pdf_file/0031/94567/Great-South-Coast-Regional-Growth-Plan-May-2014.pdf

- Gross regional product (GRP)²⁴¹ is expected to drop by 14% in the June and September quarters as a consequence of lower incomes, loss of consumer and business confidence and disruptions to global supply chains.
- Unemployment is expected to rise to 11% in the September quarter and the number of jobs has already fallen by almost 7% across Victoria since March 2020.²⁴²

While the true extent of the impact on the Barwon South West Region is unclear, it is likely to reflect the economic trends for Victoria.

9.1.1 Key economic indicators

Key economic indicators across the Barwon South West Region for the period 2018-19 are summarised below:²⁴³

Gross Regional Product (GRP) reflects the region’s contribution to the broader State economy and the value of the regional economy.

- Overall, the Barwon South West Region contributed \$22.2 billion to the Victorian economy, which was 4.9% of the total for the State (Gross State Product is estimated at \$454.6 billion).

GRP per worker provides an indication of workforce participation.

- Overall, the Barwon South West Region had a lower than average rate of productivity at \$116,300 compared with \$166,496 per worker for Victoria.

Table 56. Economic Indicators for BSWR²⁴⁴

Economic Indicators	
Gross Regional Product (\$ million) (2019)	\$22,230m
Gross Regional Product per worker (\$) (2019)	\$116,300
10-year average annual GRP growth rate (2009-2019)	0.9%
Total Jobs (2019)	191,141
Annual jobs growth rate (2018-2019)	2.8%
5-year average annual jobs growth rate (2014-2019)	2.8%
10-year average annual jobs growth rate (2009-2019)	1.8%

The number of local jobs reflects the health of the labour market.

242 DTF (2020): <https://www.dtf.vic.gov.au/economic-and-financial-updates/coronavirus-economic-outlook>

243 DJPR (2020): <https://www.rdv.vic.gov.au/information-portal/table-and-chart>

244 DJPR (2020): <https://www.rdv.vic.gov.au/information-portal/table-and-chart>

- Overall, the Barwon South West Region provided over 190,000 jobs, which was 7.1% of the total number of jobs for the state (2.73 million jobs).

Labour force participation measures an economy’s active workforce, while the unemployment rate measures the loss of productive resources to the economy.

- Overall, the Barwon South West Region’s labour force participation rate in 2016 was 62.2%, which is higher than the Victorian average (60.5%)
- The unemployment rate (4.02%) in 2019 Q4, was below the State average (4.8%).

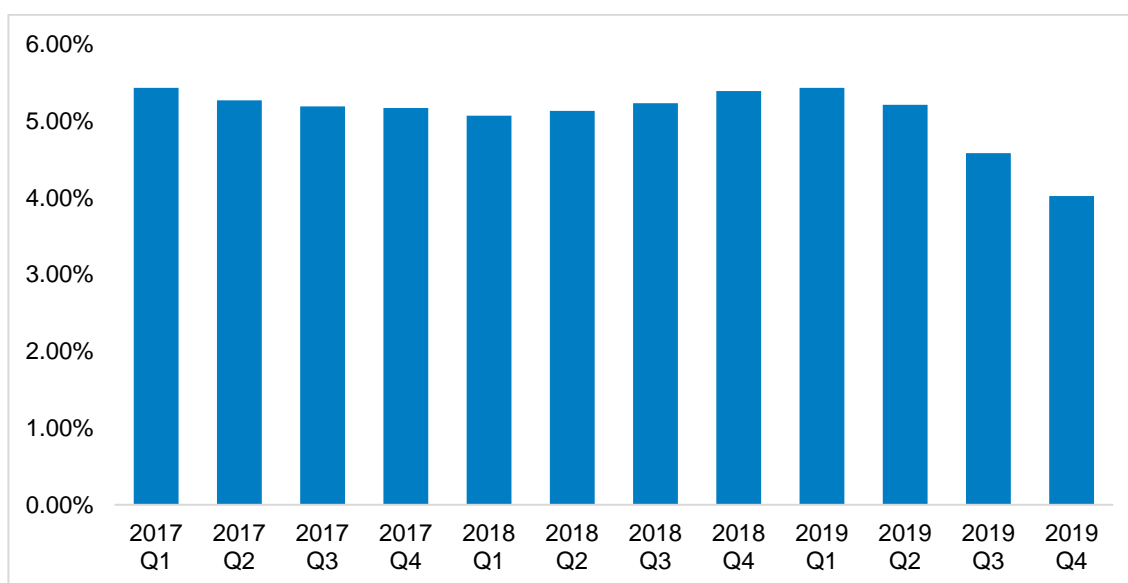


Figure 37. Quarterly unemployment rate (%) for BSWR (2017-2019)

Table 57. Labour Force Indicators for BSWR (2016)²⁴⁵

Indicators	Total	Percentage
Labour force participation (2016)	184,643	62.2%
<i>Participation at 65 years plus</i>	9,055	12.0%
People receiving an unemployment benefit (2016)	14,760	6.3%
<i>Receiving an unemployment benefit for more than 180 days</i>	12,432	5.3%
Youth unemployment (ages 15-24) (2016)	3,649	11.2%

245 DJPR (2020): <https://www.rdv.vic.gov.au/information-portal/table-and-chart>

9.1.2 Industry and employment

The main industries by number of jobs in the Barwon South West Region overall in 2016 were Health Care and Social Assistance (16% of all jobs), Retail Trade (13% of all jobs) and Education and Training (10% of all jobs), as shown below:

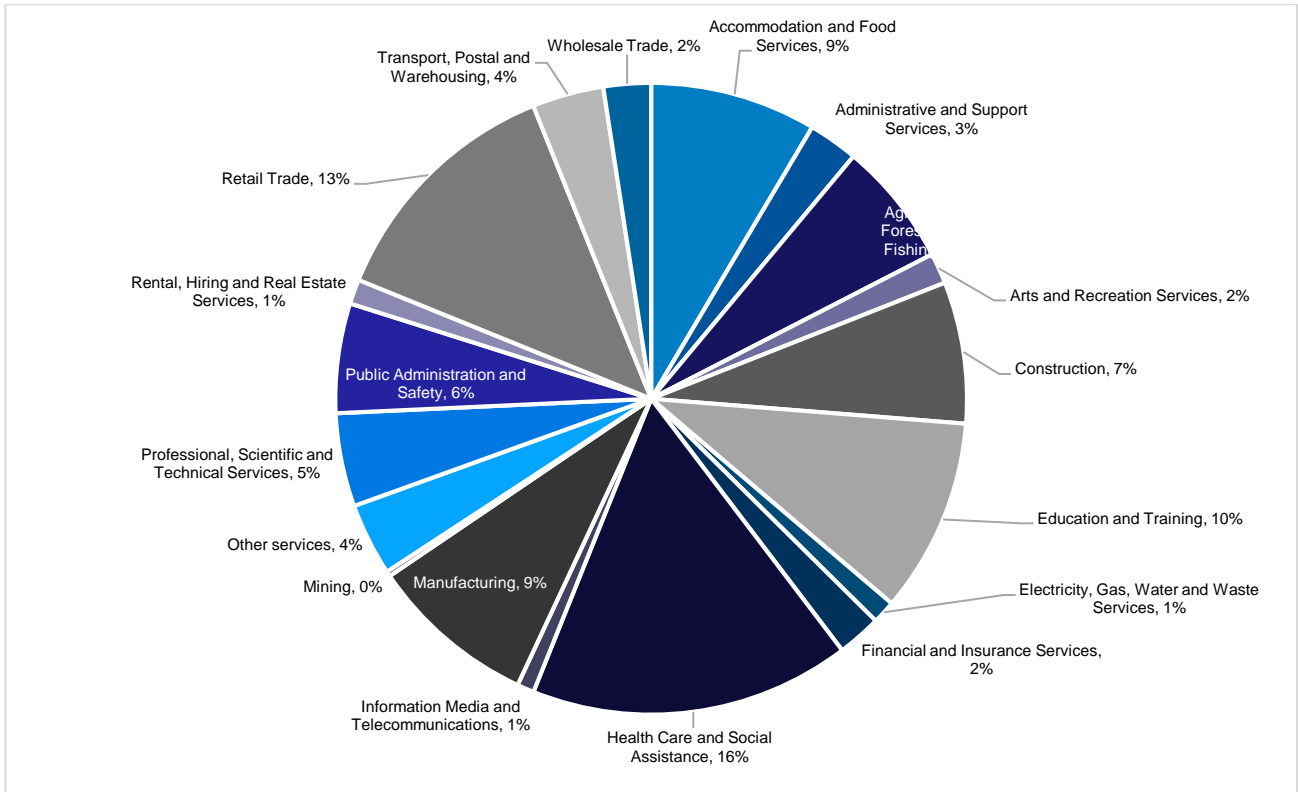


Figure 38. Jobs by industry in BSWR²⁴⁶

The main industries by number of businesses in the Barwon South West Region overall in 2019 were Construction (18% of all businesses), Agriculture, Forestry and Fishing (17% of all businesses) and Retail Trade (9% of all businesses), as shown below:²⁴⁷

246 DJPR (2020): <https://www.rdv.vic.gov.au/information-portal/table-and-chart>
 247 DJPR (2020): <https://www.rdv.vic.gov.au/information-portal/table-and-chart>

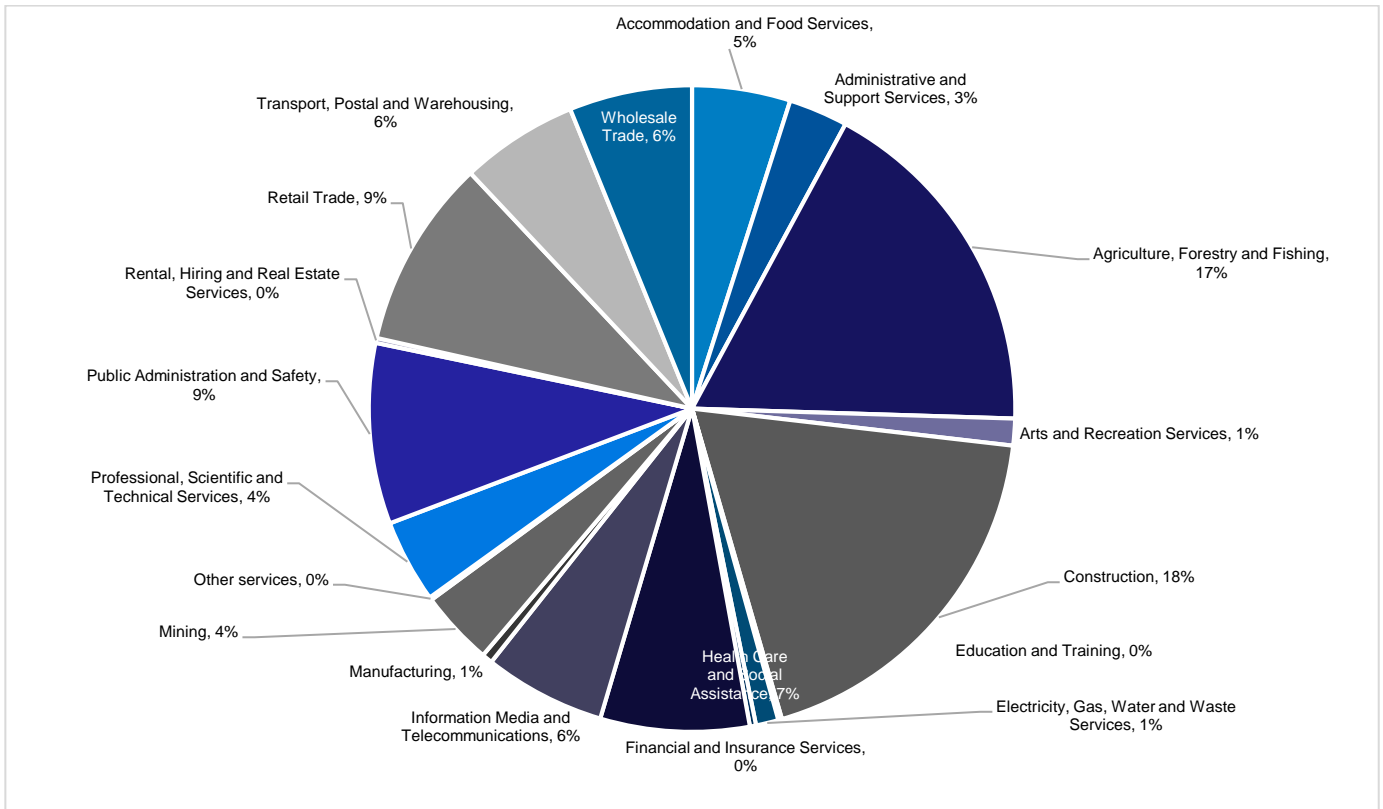


Figure 39. Businesses by industry for BSWR (2019)

Of the 36,758 businesses in the region, over 36% are non-employed businesses, while over 61% are small businesses with less than 20 employees.

Table 58. Businesses by size in BSWR (2018) ²⁴⁸

Businesses by size	Percentage
Large (200+ employees)	0.05%
Medium (20-199 employees)	2.24%
Small (<20 employees)	61.10%
Non-employed businesses	36.61%

9.2 Political and legal factors

There are eight electoral Regions in Victoria. Five Members of Parliament (MPs) represent each Region in the Victorian Parliament's Legislative Council (Upper House). The principal role of people who are elected to represent a Region is to review legislation that has been passed by the Lower House. Barwon South West sits within the Western Victorian Region.

²⁴⁸ DJPR (2020): <https://www.rdv.vic.gov.au/information-portal/table-and-chart>

A breakdown of state and federal electoral divisions can be found below. The Victorian Electoral Commission and the Federal Electoral Commission use different borders distinctions that Emergency Management Regions due to the need to separate groups by population.²⁴⁹ Therefore, the list below includes all divisions that cross into BSWR:

State electorates:

- Bellarine
- Geelong
- Lara
- Lowan
- Polwarth
- Ripon
- South Barwon
- South-West Coast

Federal division:

- Corangamite
- Corio
- Wannon

10. Operational Learnings

The Victorian emergency management sector supports a culture of continuous improvement by:

- Encouraging the sector to share lessons, both positive actions to sustain and areas for improvement
- Encouraging learning from both assurance activities and contemporary good practice
- Focusing on systems of work, rather than the performance of individuals
- Recognising that identifying and implementing sustainable solutions takes time, resources and opportunity

²⁴⁹ Victorian Electoral Commission Map of districts: <https://www.parliament.vic.gov.au/findelectorate/>

In November 2015, Victoria's first sector-wide lessons management framework, EM-LEARN, was approved. This framework further supports the development of a culture of continuous improvement and outlines a model for lessons management and how it will be implemented into the sector, particularly operational activities initially.

Lessons management involves the identification and learning of lessons captured through assurance and learning activities (including debriefing, monitoring and reviews) occurring before, during and after emergencies. This process of moving from identifying lessons to learning lessons is guided by the lessons management life cycle within the EM-LEARN Framework, and should inform emergency management planning to ensure ongoing continuous improvement.

Operational learnings identified from across the State over the past 12 months include:

Declarations

- It was observed that there was little discussion / communication with the regions regarding the State of Disaster declaration for the summer fires, which resulted in confusion around what arrangements were required to be put in place at the regional level to support this. However, the declaration did result in the appointment of a State Relief Coordinator to support relief activities at the regional level and the State Response Controller at the State level which was viewed positively.
- Observations indicate that during the lead-up to a Code Red Declaration on 21 November 2019, there were issues with responding agencies accessing timely intelligence, information and predictions to enhance their operations due to how quickly the data was being updated. Specifically, accessing EM-COP was highlighted as challenging at times.

IT

- IMT's highlighted the difficulties encountered with IT systems, connecting to networks and the hardware in operational facilities. Observations indicate that there are challenges in accessing and using multiple systems including EM-Drive, Webmail, EM-COP, IMS, Fireweb and FIRS.

Evacuation

- Observations indicate that Controllers were hesitant to consider robust evacuation planning until the exact location of the towns requiring evacuation was known. Evacuation planning highlighted the need for targeted messaging to people within evacuation areas, and the importance of having local agencies (i.e. CFA) involved in the evacuation planning process and ensuring that relief centres are located in 'safe' areas.
- Observations indicate that it is difficult to plan for or assume where people will want to go post evacuation or assuming what their needs might be. It is also very important that local councils are involved in the planning and implementation of any evacuation or reception centres.

Planning

- Early identification of potential storm/flood hazards allowed for planning and pre-positioning of storm and flood teams in IMT's. The adoption of standard processes for assuring the implementation of safety alerts related to thunderstorms worked well.

Information Management and Intelligence

- Observations indicate that relief information on VicEmergency was not always consistent with information distributed via community newsletters and other channels and that community communications need to be clear and targeted to the audience.
- Observations indicate that communications between the incident, regional and State tiers could be improved, in terms of building relationships, information sharing and reporting - and that all tiers need to be proactive and take responsibility for ensuring this is done in a clear and timely manner.
- Observations indicate that the lack of an intelligence unit within IMT's and Sector Commanders in the field impedes data collection at the incident level. There is value in establishing an intelligence within ICCs to centrally and consistently coordinate and manage damage assessment and other data which is collected from sources in various formats.
- It was observed that the SCC experienced difficulties in obtaining sufficient intelligence from across the incident and regional tiers. At times there was a divergence of views between the State and incident tiers regarding what the priority intelligence requirements were, which was exacerbated by the fact that the State tier implemented new requirements - which were added to the existing procedures and products during times of peak operational demand on intelligence teams across all levels.

Personnel

- Fatigue management is a continuing issue. Personnel have concerns on shift length, rostering principles, rostering practices, entitlements and their general understanding of how to self-manage fatigue in relation to assigned shifts.
- Observations indicate staff are being activated into functional roles when they do not necessarily have the right accreditation or experience to perform the role effectively. In addition to being a potential safety issue of having unaccredited staff performing functional roles in an emergency, it also places pressure on others within the functional cell to cover the knowledge/experience gap and can cause frustration across the entire IMT.

11. Data sources

Table 59. Metadata

Item	Details
Report section	5. Regional Context 6. Natural Environment 7. Built Environment 8. Social Environment 9. Economic Environment
Data set	Regional Development Victoria Information Portal
Data source	Online
Location	https://www.rdv.vic.gov.au/information-portal/table-and-chart
Data accessed	July 2020
Data type	Geospatial database
Custodian	DJPR
Publisher	DJPR
Coverage	Victoria
Frequency	Approx. every four years

Item	Details
Report section	6. Natural Environment
Data set	Mean monthly and mean annual temperature data - maximum, minimum and mean (based on standard 30-year period 1961-1990)
Data source	Online
Location	http://www.bom.gov.au/jsp/ncc/climate_averages/temperature/index.jsp
Data accessed	August 2020
Data type	Geospatial database
Custodian	BOM
Publisher	BOM
Coverage	Australia
Frequency	Unknown

Item	Details
Report section	6. Natural Environment
Data set	Mean monthly, seasonal and annual rainfall data (based on standard 30-year period 1981-2010)
Data source	Online
Location	http://www.bom.gov.au/jsp/ncc/climate_averages/rainfall/IDCraingrids.jsp
Data accessed	August 2020
Data type	Geospatial database
Custodian	BOM
Publisher	BOM
Coverage	Australia
Frequency	Unknown

Item	Details
Report section	6. Natural Environment
Data set	Design Rainfall Data System
Data source	Online
Location	http://www.bom.gov.au/water/designRainfalls/revised-ifd/
Data accessed	August 2020
Custodian	BOM
Publisher	BOM
Coverage	Australia
Frequency	Unknown

Item	Details
Report section	6. Natural Environment
Data set	Average annual and monthly days of rain
Data source	Online
Location	http://www.bom.gov.au/jsp/ncc/climate_averages/raindays/index.jsp?period=anandproduct=5mm#maps
Data accessed	August 2020
Custodian	BOM
Publisher	BOM
Coverage	Australia
Frequency	Unknown

Item	Details
Report section	6. Natural Environment
Data set	Bushfire Prone Areas
Data source	Online
Location	https://discover.data.vic.gov.au/dataset/designated-bushfire-prone-area-bpa
Date produced	Last updated 24/3/2020 – produced 07/09/2011
Data accessed	09/05/2020
Data type	Geospatial database
Custodian	DELWP
Publisher	DELWP
Coverage	Victoria
Frequency	Unknown

Item	Details
Report section	6. Natural Environment
Data set	Major River Basins of Victoria
Data source	Online
Location	https://discover.data.vic.gov.au/dataset/awrc-major-river-basins-of-victoria
Date produced	Last updated 05/09/2020 – produced 01/08/2014
Data accessed	August 2020
Data type	Geospatial database
Custodian	DELWP
Publisher	DELWP
Coverage	Victoria
Frequency	Unknown

Item	Details
Report section	6. Natural Environment
Data set	Vicmap Lite: Statewide data series depicting major features, public land, vegetation, hydrology, transport and administrative data
Data source	Online
Location	https://discover.data.vic.gov.au/dataset/vicmap-lite
Date produced	Last updated 05/09/2020 – produced 01/08/2014
Data accessed	August 2020
Data type	Geospatial database
Custodian	DELWP
Publisher	DELWP
Coverage	Victoria
Frequency	As required

Item	Details
Report section	6. Natural Environment
Data set	1 in 100 year flood extent
Data source	Online
Location	https://discover.data.vic.gov.au/dataset/1-in-100-year-flood-extent
Date produced	Last updated 11/4/2020 – produced 01/08/2014
Data accessed	August 2020
Data type	Geospatial database
Custodian	DELWP
Publisher	DELWP
Coverage	Victoria
Frequency	As required

Item	Details
Report section	6. Natural Environment
Data set	Flood Warning Catchment Areas
Data source	Online
Location	http://www.bom.gov.au/metadata/catalogue/19115/ANZCW0503900441?template=full
Data accessed	August 2020
Data type	Geospatial database
Custodian	BOM
Publisher	BOM
Coverage	Australia
Frequency	Unknown

Item	Details
Report section	7. Built Environment
Data set	Potential Impact Reports (by LGA)
Data source	EM-COP
Location	EM-COP
Date produced	May 2020
Data accessed	July 2020
Data type	Geospatial database
Custodian	EMV
Publisher	EMV
Coverage	Victoria
Frequency	As required

Item	Details
Report section	7. Built Environment
Data set	FOI – Point – Vicmap Features of Interest
Data source	Online
Location	https://discover.data.vic.gov.au/dataset/foi-point-vicmap-features-of-interest
Date produced	Last updated 28/05/2020 – produced 1/05/2009
Data accessed	July 2020
Data type	Geospatial database
Custodian	DELWP
Publisher	DELWP
Coverage	Victoria
Frequency	As required

Item	Details
Report section	7. Built Environment
Data set	Electricity
Data source	Online
Location	https://data.gov.au/dataset/ds-aurin-aurin%3Adatasource-AU_Govt_GA-UoM_AURIN_DB_national_major_power_stations_2016/details?q=Major%20Power%20Stations
Date produced	Last updated December 2016
Data accessed	August 2020
Data type	Geospatial database
Custodian	Australian Government
Publisher	Australian Government
Coverage	Australia
Frequency	As required

Item	Details
Report section	7. Built Environment
Data set	PTV Public Transport
Data source	Online
Location	https://discover.data.vic.gov.au/dataset/public-transport-a-collection-of-ptv-datasets
Date produced	Last updated 30/1/2020 – produced 07/06/2012
Data accessed	09/05/2020
Data type	Geospatial database
Custodian	Public Transport Victoria
Publisher	Public Transport Victoria
Coverage	Victoria
Frequency	Quarterly

Item	Details
Report section	7. Built Environment
Data set	Roads
Data source	Online
Location	https://discover.data.vic.gov.au/dataset/road-network-vicmap-transport
Date produced	Last updated 05/09/2020 – produced 1/08/2014
Data accessed	August 2020
Data type	Geospatial database
Custodian	DELWP
Publisher	DELWP
Coverage	Victoria

Frequency	As required
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Item	Details
Report section	7. Built Environment
Data set	EPA Victoria Landfill Register
Data source	Online
Location	https://discover.data.vic.gov.au/dataset/epa-victoria-victorian-landfill-register-vlr-location-polygons
Date produced	11/01/2020
Data accessed	09/05/2020
Data type	Geospatial database
Custodian	EPA
Publisher	EPA
Coverage	Victoria
Frequency	As required

Item	Details
Report section	7. Built Environment
Data set	Emergency Services
Data source	Ambulance Victoria Data Sets
Location	https://www.ambulance.vic.gov.au/ambulance-victoria-data-sets/
Data accessed	August 2020
Data type	Database
Custodian	AV
Publisher	AV
Coverage	Victoria
Frequency	Annually

Item	Details
Report section	8. Social Environment
Data set	Population
Data source	Australian Bureau of Statistics
Location	https://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/3218.02018-19?OpenDocument
Data accessed	August 2020
Data type	Database
Custodian	ABS
Publisher	ABS
Coverage	Australia
Frequency	As needed – next issue expected for release on 30/03/2021

Item	Details
Report section	8. Social Environment
Data set	Hospital locations
Data source	Online
Location	http://data-dhs.opendata.arcgis.com/datasets/5000b3c446ed419eb590baa3832eb8f7_0
Date produced	Last updated 20/11/2019 – produced 28/07/2016
Data accessed	09/05/2020
Data type	Spatial
Custodian	DHHS
Publisher	DHHS
Coverage	Victoria

Frequency	Unknown
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Item	Details
Report section	8. Social Environment
Data set	School enrolments
Data source	Online
Location	https://www.education.vic.gov.au/about/department/Pages/factsandfigures.aspx
Date produced	Last updated 01/07/2019 – produced 01/01/2010
Data accessed	16/06/2020
Data type	Spreadsheet
Custodian	DET
Publisher	DET
Coverage	Victoria
Frequency	Six-monthly

Item	Details
Report section	8. Social Environment
Data set	Aged Care
Data source	Online
Location	https://www.gen-agedcaredata.gov.au/Resources/Access-data/2020/March/GEN-data-People-using-aged-care
Date produced	Last updated 03/03/2020
Data accessed	August 2020
Data type	Spreadsheet
Custodian	Australian Institute of Health and Welfare
Publisher	GEN Aged Care Data
Coverage	Australia
Frequency	Unknown

Item	Details
Report section	8. Social Environment
Data set	Areas of Aboriginal cultural heritage sensitivity
Data source	Online
Location	https://discover.data.vic.gov.au/dataset/areas-of-cultural-heritage-sensitivity
Date produced	Last updated 11/07/2020 – produced 23/05/2018
Data accessed	06/08/2020
Data type	Shapefile
Custodian	DPC
Publisher	DPC
Coverage	Victoria
Frequency	Quarterly

Item	Details
Report section	8. Social Environment
Data set	Victorian Heritage Register
Data source	Online
Location	https://discover.data.vic.gov.au/dataset/victorian-heritage-register
Date produced	Last updated 05/09/2020 – produced 11/05/2016
Data accessed	06/08/2020
Data type	Geospatial database
Custodian	DELWP

Publisher	DELWP
Coverage	Victoria
Frequency	Fortnightly

Item	Details
Report section	8. Social Environment
Data set	Areas of Cultural Heritage Sensitivity
Data source	Online
Location	https://discover.data.vic.gov.au/dataset/areas-of-cultural-heritage-sensitivity
Date produced	Last updated 18/05/2020 – produced 20/06/2019
Data accessed	06/08/2020
Data type	Geospatial database
Custodian	DPC
Publisher	DPC
Coverage	Victoria
Frequency	Quarterly

Item	Details
Report section	Natural Environment
Data set	Climate average maps reference period 1961 - 1990
Data source	Online
Location	http://www.bom.gov.au/climate/averages/maps.shtml
Data accessed	1/07/2020
Data type	ASCII grid
Custodian	Bureau of Meteorology
Publisher	Bureau of Meteorology
Coverage	Victoria
Frequency	Fortnightly

12. List of Abbreviations

Figure 40. List of Abbreviations

Acronym	Description
ABC	Australian Broadcasting Corporation
ABS	Australian Bureau of Statistics
ACHRIS	Aboriginal Cultural Heritage Register and Information System
AEMO	Australian Energy Market Operator
AEP	Annual Exceedance Probability
ARI	Average Reference Interval
BOM	Bureau of Meteorology
CFA	Country Fire Authority
CMA	Catchment Management Authority
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DAFF	Department of Agriculture
DAWR	Department of Agriculture and Water Resources
DELWP	Department of Environment, Land, Water and Planning (VIC)
DET	Department of Education and Training (VIC)
DHHS	Department of Health and Human Services (VIC)
DISER	Department of Industry, Science, Energy and Resources
DJPR	Department of Jobs, Precincts and Regions (VIC)
DOT	Department of Transport
DTF	Department of Treasury and Finance
EMLA	Emergency Management Legislation Amendment
EMV	Emergency Management Victoria
EPA	Environment Protection Authority
FDP	Fire Danger Period
FFMV	Forest Fire Management Victoria
GRP	Gross Regional Product
ICC	Incident Control Centre
ICU	Intensive Care Unit
IFD	Intensity-Frequency-Duration
LGA	Local Government Area
MEMP	Municipal Emergency Management Plan
NWMR	North West Metro Region
PTV	Public Transport Victoria
RCC	Regional Control Centre
REMP	Regional Emergency Management Plan
REMPC	Regional Emergency Management Planning Committee
SCC	State Control Centre
SEIFA	Socio-Economic Indexes for Areas
SEMP	State Emergency Management Plan
SES	State Emergency Service (VIC)
SLS	Surf Life Saving (VIC)
SSIP	State Significant Industrial Precinct

13. Document information

Document details

Criteria	Details
Document title:	Environmental Scan Report: Barwon South West Region
Document owner:	Information Management and Intelligence Team, EMV

Version control

Version	Date	Description	Author
0.1	14/05/2020	Initial template created	C. Jolly
0.2	02/07/2020	First draft	J. Daly
0.3	27/07/2020	Second draft	C. Murphy
0.4	05/08/2020	Third draft	M. Frew
1.0	06/08/2020	Draft for initial consultation	C. Jolly
1.1	06/09/2020	Updated based on feedback from IREMPCs	M. Frew, M. Brereton, W. Stephenson, M. Slavtcheva, C. Jolly
1.2	09/09/2020	Proof reading	T. Penfold
2.0	14/09/2020	Final release	C. Jolly

Document approval

This document requires the following approval:

Name	Title	Organisation
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Andrew Crisp	Emergency Management Commissioner	EMV