

SECCCA Managing Climate Risk and Building Community Resilience

Worked Example: Extreme Heat in Greater Dandenong

Version 3.0

5th February 2024



About this document

Company	Spatial Vision
Purpose	Worked Example
Document File Name	Managing Climate Risk and Building Community Resilience_Business Case Worked Example Version 3_01022024.pdf
Project Client	South East Councils Climate Change Alliance (SECCCA)
Date of Issue	5 th February 2024
Project Number	SV006177
Version Number	3.0
Document Type	Project Documentation
Document Status	Final
Contact Person	Stephen Farrell
Telephone	+61 419 185 452
Email	stephen.farrell@spatialvision.com.au

Cover photo: Heat wave in St Kilda

SECCCA and Spatial Vision respectfully acknowledge the Traditional Owners of the lands on which we work, and pay respect to their Elders, past, present and future. We appreciate and acknowledge the advice and guidance of the Bunurong Land Council in assisting with the consideration of potential climate change impacts on First Nations communities, which for this study began with a focus on the Frankston Local Government Area.

Thanks to the Minderoo Foundation for supporting this project.

Contents

Contents	3
1. Document purpose.....	4
2. Introduction to Project Resources and Outputs – a guide for new participants	5
2.1. Handover Folder Structure	5
2.2. User Types	6
2.3. Steps for Project Newcomer – Understanding the Project Outputs.....	6
2.4. Dataset Directory.....	8
3. Technical Training Resources Available	12
4. Overview of Steps.....	13
5. Worked Example	15
Step 1: Purpose of Plan & Justification.....	15
Step 2: Identifying Key Focus	15
Step 3: Thinking through other considerations.....	16
Step 4: General Profile Insights (Council summary tables).....	17
Step 5: More Detailed Data Exploration (tabular data).....	19
Step 6: Exploring Spatial Data (QGIS Viewer)	23
Step 7: Developing Business Case	25

1. Document purpose

The purpose of this document is to present guidance on how the output data generated for the Enhancing Community Resilience Project can be investigated and interpreted to support the development of a business case or plan. This is done through a worked example:

Identifying the most relevant & appropriate places within Greater Dandenong to develop a Business Plan for implementing regular heat-smart workshops, specifically for older people and those who require high care.

Project data outputs provided include:

- Tabular information provided in excel spreadsheets
- Spatial data provided in spatial format (shapefiles and feature classes), symbolised and presented in QGIS Viewers
- Maps at SECCCA-wide and LGA level
- Power BI Case Studies

The purpose of this document is not to be a user guide in how to use the software that hosts the output data, but rather to provide guidance on how data interpretation can highlight findings.

The Version 2.0 update of this document includes the addition of a new section (Section 2) that provides a suggested outline of how someone new to the project could work through the available project materials, resources and data. Due to the complexities of the project and the wide array of resources available, this is intended to provide guidance on where to start and a general flow of working through the material at the different levels of understanding.

The Version 3.0 update of this document includes an additional sub-section (Section 2.4) that provides a directory of all datasets available through this project. This provides a reader an understanding of the breadth of information available to them through this project.

2. Introduction to Project Resources and Outputs – a guide for new participants

2.1. Handover Folder Structure

The Building Community Resilience project handover folder contains 5 key groupings:

- **Data:**
 - Geographic_Location: spatial data in shapefile and file geodatabase formats, clipped to the Power BI case study geographic extents
 - Metadata: information related to the data (e.g. source, date of acquisition, etc)
 - SECCCA_Wide: spatial data in shapefile and file geodatabase formats (SECCCA region)
- **Power BI:** Power BI files for each of the four geographic case studies, and instructions on how to download and interact with Power BI
- **Spatial Viewer:** The spatial viewers (climate and Minderoo data), the data being presented in these viewers, layer definition files and symbology files
 - *QGIS Spatial Viewer* pdf document provides background information on the structure of the QGIS Minderoo viewer, and some handy tips on how to interact with the data
- **Supplementary Material:**
 - *Mapping:* static maps in PNG format of vulnerability analysis outputs at the LGA and SECCCA-wide scales. Also includes climate-related maps at the SECCCA-wide scale
 - *Reports*
 - *Paper 1 – Definitions and Approaches*
 - *Paper 2 – Vulnerable Populations*
 - *Paper 3 – Methods and Applications*
 - *Paper 4 – Findings and Guidance*
 - *Paper 5 – Case Studies*
 - *Replicating Project Progress*
- **Tables:**
 - Council Summary: provides summary tables for each LGA
 - Geographic Locations: provides the data used for the Geographic Case Studies
 - Other excel spreadsheets: the more detailed excel spreadsheets focussing on climate, vulnerability, and a combination of both

2.2. User Types

Different types of users will require various levels of understanding of the project outputs based on their needs and may be dependent on the level of comfort and knowledge the user has with data exploration and data exploration tools (e.g. excel navigation, spatial data exploration and analysis, Power BI).

Readers: Reader-users are those who may only need a broad understanding of the projects, and who are interested in the overall project findings. They may also be limited in their skills to interact with or understand data (in excel or spatial format).

Beginner-level data user: Beginner-level data users may have limited working understanding of data in excel format or spatial format. For example, they may be able to open and look at data in an excel spreadsheet, but struggle with interpreting large datasets or using equations and pivot tables. Beginner users are likely to be comfortable looking at and interpreting static map outputs.

Moderate-level data users: Moderate-level data users are more comfortable with interacting with excel tables, including using pivot tables and creating their own graphs. They are likely to also be more comfortable with looking at spatial data in the viewers, including being able to open, pan and zoom.

Advanced-level data users: Advanced-level data users are those who regularly and comfortably interact with data (excel data and/or spatial data), and understand the deeper concepts of data interpretation. Advanced users can include people from a council's GIS team, or someone who has exposure to data on a semi-regular basis.

** Note that all data users (including Reader- and Beginner-level data users) are more than welcome (and encouraged) to explore all data available to them if they have the capacity to undertake the recorded training available to them as part of the project outputs (See Section 3).

2.3. Steps for Project Newcomer – Understanding the Project Outputs

The following steps detail the key resources suggested to work through for someone with little to no background to this project.

1. Read Paper 4 – Findings and Guidance

User Types: All

This paper provides a good starting point for a project newcomer to get a broad understanding of the project background and an overview of high level findings (for example, highly vulnerable suburbs for each council for each sub-population).

It is then recommended for the newcomer to read the other papers, however reading Paper 4 may provide enough information for a **reader-level** user.

2. Review Council-level Summary excel table

User Types: All

This excel document will provide a newcomer more details on the vulnerability analysis outputs for their Council than what Paper 4 provides, and does not require any excel acumen to explore or understand the data.

- With beginner-level excel acumen, the user can create graphs and tables with the data they want to focus on.

It is strongly recommended that a newcomer begins by reading Paper 4 before looking at this data (or any other data) to ensure they have the background understanding.

3. Review the static maps

User Types: All

The static maps provide a visual understanding of the distribution of vulnerability (for all sub-populations) across the LGAs and across SECCCA at a SA1¹ granularity. This provides a strong visual understanding of the spatial distribution of vulnerability, and allows insights as to where hotspots of vulnerability may exist (as opposed to seeing Suburb-level aggregations).

These maps can be used within reports, business cases, on their own, etc.

Steps 1 to 3 provide enough detail for a **reader-level user** to understand the key findings of the project. A **beginner-level data user** may start to explore and interact with the Council summary data.

4. Review the Power BI Geographic Case Studies

User Types: Beginner-, Moderate- and Advanced-level data users

This step is for those interested in reviewing the geographic case studies within the Power BI environment. The case studies provide context of which variables may be considered within a geographic extent in relation to a climate hazard scenario. A user with limited Power BI skills will be able to easily read and interact with the viewers (refer to the *PowerBI Download Instructions* document within the Power BI parent folder for basic instructions), while a user with working and advanced knowledge of Power BI could use these viewers as examples to refer to if replicating the case study for their Council.

5. Explore the more detailed excel spreadsheets

Target User Types: Moderate- and Advanced-level data users (Excel user)

Although a beginner-level data user is more than welcome to look at and explore the excel spreadsheets, the more detailed excel spreadsheets are targeted towards people who have more working knowledge of excel (i.e. can work with pivot tables).

This step allows users (with the appropriate level of skill) to choose the information they want to see in the various pivot tables, filter results to show highest vulnerabilities across multiple indicators, etc.

Resources to help a user explore and understand these datasets include:

- The *SECCCA Managing Climate Risk and Building Community Resilience Workshop #1* recording (available on the SECCCA Sharepoint)
- The following sections of this document.

¹ SA1 refers to 'Statistical Areas 1', and are the smallest geographical areas that the Australian Bureau of Statistics (ABS) publicly release census data. SA1s have a population of between 200 and 800 people with an average population size of approximately 400 people.

6. Explore the Spatial Viewers

Target User Types: Moderate- and Advanced-level data users (spatial user)

The spatial viewers allow a user to interact with and investigate the spatial data. For a moderate-level data user, they can simply use these as tools to see data at different scales, take screenshots and visually explore the various datasets available to them. A more advanced-level data user can use these tools to interrogate data (e.g. see what's driving a high vulnerability rank for a particular area), make their own maps with user-chosen symbology, and undertake any further spatial analysis they would like.

Resources available for a user to become a moderate- or advanced-level data user include:

- Introduction to QGIS Training Course
 - Recording of course
 - Course workbook

Training on basic usage of QGIS for those with little or no GIS experience (6 hours).

- QGIS Mentoring
 - Recording of Mentoring sessions
 - User Guide

2-hour mentoring session on the usage of the QGIS Viewers. User guide provides step-by-step guidance on how to address relevant worked examples.

7. Explore the Spatial Data

Target User Types: Advanced-level data users (spatial user)

The spatial data is located in the 'Data' parent folder. This data is the data being referred to within the QGIS viewers (therefore must not be deleted or moved as the data in QGIS have a relative pathway). The data in this folder are provided in shapefile and file geodatabase format, and will predominately be used by the council GIS Team (or those very comfortable with spatial data).

Examples of use for this data include: a GIS team member uploading key datasets into the council's internal GIS systems (e.g. Intramaps).

2.4. Dataset Directory

Although this worked example documentation focuses specifically on heat as the climate hazard and two sub-populations, the project outputs contain a wide variety of different datasets that can be interrogated and used for different decision-making purposes. The below data directory below identifies the datasets that are available, alongside with key details of the dataset such as the dataset source (or multiple sources use for derivative outputs).

The datasets used for this worked example document are highlighted in light grey.

Category	Sub-Category	Dataset	Metric Type	Source	Notes
Vulnerable Sub-Populations		First Nations - People Who Require a High Level of Care	Score & rank	2021 Census (ABS), Services Australia, Vicmap, Geoscience Australia	Vulnerability scores and rankings of each sub-populations were calculated with key sensitivity and adaptive capacity components. Refer to Paper 3 for methodology details.
		First Nations - Age 55 and Over		2021 Census (ABS), Vicmap, Geoscience Australia	
		First Nations - Age 65 and Over		2021 Census (ABS), Vicmap, Geoscience Australia	
		People Who Require a High Level of Care		2021 Census (ABS), Services Australia, Vicmap, Geoscience Australia	
		Those Experiencing Homelessness or Insecure Housing		2021 Census (ABS), Crime Statistics Agency (CSA), Australian Digital Inclusion Index, Planning Vic, Vicmap, Geoscience Australia, DFFH Registered Rooming Houses	
		Low Income		2021 Census (ABS), Services Australia, Vicmap, Geoscience Australia, Crime Statistics Agency (CSA), Australian Digital Inclusion Index, DFFH Rental Report	
		Non-English Speaking Background (NESB) - Established (Arrived in Australia >5 Years Ago)		2021 Census (ABS), Vicmap, Geoscience Australia	
		Non-English Speaking Background (NESB) - Recent Arrival (Arrived in Australia <1 Year Ago)		2021 Census (ABS), Vicmap, Geoscience Australia	
		Non-English Speaking Background (NESB) - Recent Arrival (Arrived in Australia <5 Years Ago)		2021 Census (ABS), Vicmap, Geoscience Australia	
		Non-English Speaking Background (NESB) - Recent Arrival (Recent Arrivals with a Bridging VISA)		2021 Census (ABS), Vicmap, Geoscience Australia, Department of Home Affairs	
		Older Age - Age 55 Years and Over		2021 Census (ABS), Vicmap, Geoscience Australia	
		Older Age - Age 65 Years and Over		2021 Census (ABS), Vicmap, Geoscience Australia	
		Older Age - Age 85 Years and Over		2021 Census (ABS), Vicmap, Geoscience Australia	
		Single Mothers		2021 Census (ABS), Services Australia, Vicmap, Crime Statistics Agency (CSA)	
		Youth - Age 15 to 19 Years		2021 Census (ABS), Services Australia, Vicmap, Australian Digital Inclusion Index, Planning Vic, Victorian Agency for Health Indicators, VPA Open Space	
		Youth - Age 20 to 24 Years		2021 Census (ABS), Services Australia, Vicmap, Australian Digital Inclusion Index, Planning Vic, Victorian Agency for Health Indicators, VPA Open Space	
Youth - Age 15 to 24 Years	2021 Census (ABS), Services Australia, Vicmap, Australian Digital Inclusion Index, Planning Vic, Victorian Agency for Health Indicators, VPA Open Space				
Broader Capacity Considerations	Emergency Services	Ambulance Stations	Count, % Coverage of SA1 by Asset with 2km & 10km Buffer	Vicmap Features of Interest, Open Street Map Points of Interest	
		Fire Stations			
		Police Stations			
		SES Units			
		Hospitals			
		Neighbourhood Safe Places			

Category	Sub-Category	Dataset	Metric Type	Source	Notes
	Self-Sufficiency Measures	Bus Stops	Count, % Coverage of SA1 by Asset with 400m Buffer	Public Transport Victoria (PTV)	
		Train Stations			
		Tram Stops			
		Banks	Count, % Coverage of SA1 by Asset with 1km & 5km Buffer	Open Street Map	
		Post Offices			
		Doctors			
		Pharmacies			
		Supermarkets & Local Shops			
	Petrol Stations				
	Social Infrastructure Measures	Aged Care Facilities & Retirement Villages	Count, % Coverage of SA1 by Asset with 1km & 5km Buffer	Vicmap Features of Interest, Open Street Map Points of Interest	
		Child Care Centres, Kindergartens & MCHCs			
		Community Centres & Halls			
		Libraries			
		Life Saving Clubs			
		Places of Worship			
		Schools & Universities			
		Sporting Facilities			
	Planning Zones	Capital City	% Coverage per SA1	Vicmap Planning Zones	
		Commercial & Business			
		Comprehensive Development			
Education					
Farming and Green Wedge					
Industrial					
Parks, Reserves, Cemeteries & Recreation Area					
Residential					
Transport					
Utilities & Government					
Climate	Inundation and Flood	Flood Extent in 1/100 Year Event	% Coverage per SA1	Melbourne Water	
		Sea Level Rise at 20cm, 47cm and 82cm (and with 1% AEP Storm forcing)		Coastal Inundation Database	
Climate	Temperature	Maximum Temperature	Absolute & % Change from Baseline	VCP 19	Data provided for three climate models, two carbon emission scenarios and four timeframes (2030, 2050, 2070 & 2090).
		Minimum Temperature			
		Maximum Temperature (Days above 35°C)			
		Minimum Temperature (Days below 2°C)			
		Heat Wave Events/Per Year			
		Heat Stress Days			
		Extreme Temperature in 1/100 Year Event			

Category	Sub-Category	Dataset	Metric Type	Source	Notes
		Heat Health at 30°C (Days)	% Change from Baseline		
	Rainfall	Total Annual Rainfall	Absolute & % Change from Baseline	VCP 19	
		Rainfall (Days above 10mm)			
		Extreme Rainfall in 1/100 Year Event			
		Standard Precipitation Index			
	Fire	Bushfire Management Overlay	% Coverage per SA1	Vicmap Planning Overlays	
	Historical Climate Data	Maximum Temperature	Absolute	VCP 19	Decadal averages for historic climate data from the 1970s to 2010s.
		Minimum Temperature			
		Maximum Temperature (Days above 35°C)			
		Minimum Temperature (Days below 2°C)			
		Heat Wave Events/Per Year			
		Heat Stress Days			
		Extreme Temperature in 1/100 Year Event			
		Total Annual Rainfall			
Rainfall (Days above 10mm)					
Extreme Rainfall in 1/100 Year Event					
Broader Community Factors	Self-Sufficiency Measures	Volunteerism - Voluntary Work for an Organisation	% Density (Pop/Total Pop) per SA1	2021 Census (ABS)	
		Experience - Same Address as 5 Years Ago			
		Education - Completed Year 12 or Equivalent			
		Car Ownership - Two or More Motor Vehicles per Household			
	Additional Vulnerability Measures	Heart Related Condition	% Density (Pop/Total Pop) per SA1	2021 Census (ABS)	
		Respiratory Related Condition	% Density (Pop/Total Pop) per SA1	2021 Census (ABS)	
		Health Care Card or Concession Card Holders	% Density (Pop/Total Pop) per SA2	Services Australia	
		Average Annual Income	\$ per SA1	2021 Census (ABS)	
		Youth - Aged 0 to 4 Years	Total Population	2021 Census (ABS)	
	Social Connection Measures	Crime - Total Offences per Suburb in 2021	Absolute	Crime Statistics Agency (CSA)	
		Low Feelings of Trust per LGA	% difference from Victorian average	Victorian Population Health Survey 2020	
		Low Tolerance of Diversity per LGA			
		Low Feeling of Being Valued by Society per LGA			
Environmental Factors		Heat Vulnerability Index (HVI)	Score	Planning Vic	
		Tree Cover	% Coverage per SA1	Planning Vic	
		Open Space Walkability in 400m	% Coverage per SA1	VPA Open Space	

3. Technical Training Resources Available

- Introduction to QGIS Training Course

- Recording of course
- Course workbook

Training on basic usage of QGIS for those with little or no GIS experience (6 hours).

- QGIS Mentoring

- Recording of Mentoring sessions
- User Guide

2-hour mentoring session on the usage of the QGIS Viewers. User guide provides step-by-step guidance on how to address relevant worked examples.

- SECCCA Managing Climate Risk and Building Community Resilience Workshop #1 Recording

- Provides recording of the worked demonstration outlined in this document.

4. Overview of Steps

The general steps to follow when investigating the data for the development of a business case are as follows:

Before Commencing

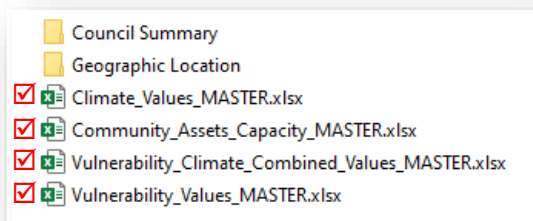
1. Define the purpose of your plan/business case
2. Ask yourself the key focuses:
 - A. Do you already have a *vulnerable sub population/s* you are concerned about?
 - B. Do you have a *climate hazard* you're particularly concerned about?
 - C. Do you have a particular *location* you're concerned about?
3. Consider:
 - A. Scale (SA1-level, Suburb-level, LGA-level, SECCCA-wide)
 - B. Which broader community considerations may influence general vulnerability and self-sufficiency in relation to this case study?
 - C. Which assets or services may provide broader capacity to potentially mitigate the effects of the event?

Getting into the Data

4. Understand the General Profile by exploring the Council Summary table. Suggestions for data interrogation include:
 - Review sub-population ranks and populations to see which suburbs are ranked highest

To consider: does population change your view on which Suburbs are more critical?

 - Review the climate-related variables – what's the general trends? Does it vary across the region or is it inconsequential?
 - Review relevant community consideration & asset capacity measures – Do any standout?
4. Explore the more detailed tables:



- Use the pivot table options to explore and combine different indicators (climate, vulnerability, broader capacity considerations and broader community considerations)

5. Explore data in spatial format via the QGIS Viewers

- Climate Viewer
- Minderoo Data Viewer

Developing your Business Case/Plan -

7. Develop business case/plan based on findings

- Use tabular and spatial data to derive graphs, summary tables and maps

5. Worked Example

The worked example demonstrated in this section focuses on the identification of best-placed location to hold heat wave safety workshops for older people and those with high care needs within the Greater Dandenong LGA.

This worked example will commence with a focus on the vulnerable sub-populations.

Note that this worked example outlines the steps needed to provide the data-driven insights to support a business case, rather than writing the business case itself.

Step 1: Purpose of Plan & Justification

Purpose:

Identifying the most relevant & appropriate places within Greater Dandenong to develop a Business Plan for implementing regular heat-smart workshops, specifically for older people and those who require high care.

Justification:

- The community is currently experiencing, and will increasingly continue to experience, extreme heat events.
- It is well-known that older people and people who require assistance are highly vulnerable to these events:
 - *Older persons:* more likely to have respiratory or heart related conditions, and are more likely to have underlying health conditions. May also be more resistant to turning on air-conditioning, or ask for help when required.
 - *Those requiring high care:* may be reliant on medication that goes off above certain temperatures; may be reliant on life-supporting machines that require electricity.
- Regular informative workshops will support these groups in preparing for and enduring through extreme heat events and will contribute to building the overall community resilience.
- For the most far-reaching impact, the location of these workshops should be held locally, where there are high populations of highly vulnerable older persons and highly vulnerable people who require high care.
- Potentially in an area that is likely to be experiencing more heat-related events into the near future (to support on-going resilience building)

Step 2: Identifying Key Focus

- A. *Sub-populations of concern:* Older persons (65 and older), and those requiring high care
- B. *Climate hazard of concern:* Heat-related events (heat waves, extreme temperatures, etc)
- C. *Location:* Across Greater Dandenong LGA

Step 3: Thinking through other considerations

- A. *Scale*: Identification of best locations at the suburb level (with potential to look at SA-1 level “hotspots”) to hold the workshops
- B. *Broader Community Considerations*:
- Past experience: those living in the area for less than 5 years are less familiar with the local climate and weather extremes.
 - Health-related impacts: such as those with heart related and respiratory-related conditions
 - Health care card holders and pension card holders: indication that they meet the low income threshold
- C. *Broader Capacity Considerations*:
- Those with lowered access to cool places of refuge (libraries, community centres & halls, supermarkets) are less able to escape the heat.
 - Lack of access to public transport indicate they may be walking longer distances to public transport (especially those who have no choice but to travel for appointments, work, etc).

Broader Community Factors: The additional factors that may influence general vulnerability and self-sufficiency in light of an extreme event or disaster. This is not only within vulnerable populations, but also in the community as a whole, and can relate to how self-sufficient the given population is, what general health concerns may exist and how well connected or trusting the community is to one another.

Broader Capacity Considerations: A location or geographic community can have assets that provide a number of services to the area. These assets provide broader capacities and based off the location, coverage, distance or level of service provided, they can potentially mitigate impacts of an extreme event. If these assets or services are impacted during an extreme event, there can be an increase in general vulnerability.

Step 4: General Profile Insights (Council summary tables)

Some insights that can be gleaned from this initial overview of vulnerability with the Council summary table includes:

- High Care:
 - Highest vulnerability rankings for Bangholme (10), Dandenong South (9), Noble Park North and Noble Park (7) (Figure 1, A).

*** Remember: Vulnerability Rankings are the ranks across the entire SECCCA region – therefore, Bangholme and Dandenong South are home to some of the most vulnerable ‘high care’ people across the SECCCA region.*
 - Although Dandenong South has a high vulnerability ranking, there is a very low ‘high care’ population of only 18 people. Bangholme has a slightly higher population of high care people (118). Noble Park, although having a lower vulnerability ranking than Dandenong South or Bangholme, is still ranked moderately high with a score of ‘7’, has the highest population (2,104 people) of those requiring care across Greater Dandenong (Figure 1, B).
- Older People:
 - Highest vulnerability rankings (>65 years old) for Banholme and Dandenong South (Figure 1, C).
 - Fewer older persons population in Bangholme, very high population in Dandenong South (42,35) (Figure 1, D).
 - Noble Park has a slightly lower ranking (6), but have a large population of those aged 65 and older (5,220) (Figure 1, D).
- Heat waves are likely to increase significantly across Greater Dandenong,– i.e. all suburbs to expect more heatwaves into 2050. Keysborough is expected to see the greatest increase in heatwaves with a >280% increase from current (Figure 2, A).
- The number of days exceeding the Heat Health threshold (30-degree daily average) will increase significantly, especially in Dandenong North and Noble Park North (>416% and >402% increase respectively from current into 2050) (Figure 2, B).

Values	Bangholme	Dandenong	Dandenong North	Dandenong South	Keysborough	Lyndhurst (Vic.)	Noble Park	Noble Park North	Springvale (Vic.)	Springvale South
Age 55 Over - Rank	7	7	6	7	5	5	7	6	5	6
Age 65 Over - Rank	7	6	5	7	4	5	6	5	5	6
Age 85 Over - Rank	5	4	3	1	4	1	4	4	3	5
Single Mothers - Rank	7	4	4	4	3		4	4	4	2
High Care - Rank	10	5	6	9	5		7	7	3	4
Homeless - Rank		5	6	3	5		5	6	5	5
NESB Established - Rank	9	6	8	9	7	8	8	9	6	7
NESB Recent Arrivals in the past 5Y - Rank		7	7	9	7		9	7	6	7
NESB Recent Arrivals in the past 1Y - Rank		6	8		7		8	7	5	5
NESB Bridging VISA - Rank		9	10		4		8	8	2	6
Youth 15 to 19 - Rank	8	6	8		7		8	9	9	8
Youth 20 to 24 - Rank	10	6	8		7		8	9	9	8
Youth 15 to 24 - Rank	10	6	8		7		8	9	9	8
Low Income - Rank	9	3	7	3	5		5	7	8	6
First Nations High Care - Rank	10	6	6	9	5		7	7	4	5
First Nations Age 55 and Over - Rank	10						9	4	9	
First Nations Age 65 and Over - Rank	9						8	3	8	
Age 55 Over Population	577	6,603	6,799	132	7,325	34	8,645	2,289	3,814	6,009
Age 65 Over Population	493	3,854	4,234	70	4,115	25	5,220	1,433	2,160	3,651
Age 85 Over Population	68	583	539	7	415	4	768	107	230	633
Single Mothers - Population	12	1,007	792	7	961		1,306	306	593	795
High Care - Population	118	2,050	1,508	18	1,219		2,104	494	771	1,428
Rented Public - Population		551	402	6	87		456	130	104	84
NESB Established - Population	234	13,003	9,834	191	13,760	16	14,635	3,286	6,386	10,670
NESB Recent Arrivals in the past 5Y - Population		4,762	1,453	56	2,111		5,125	476	1,436	3,598
NESB Recent Arrivals in the past 1Y - Population		654	126		197		509	47	171	313
NESB Bridging VISA Population (postcode)		34,238	14,212		680		6,760	1,686	472	6,344
Age 15 to 19 Population	16	1,478	1,343	25	1,869	7	1,645	407	805	1,116
Age 20 to 24 Population	22	2,234	1,407	44	1,970	11	2,591	483	1,011	1,875
Age 15 to 24 Population	38	3,712	2,750	69	3,839	18	4,236	890	1,816	2,991
Mean Annual Income Percentile Bracket	39.1%	35.8%	39.1%	33.0%	47.9%	43.8%	38.0%	37.8%	40.9%	35.8%
First Nations - Total Population	4	130	122	12	49		124	22	19	27
Age 55 and Over - First Nations Total Population	4						4	3	4	
Age 65 and Over - First Nations Total Population	4						4	3	4	

C
A
D
B

Figure 1: Screenshot of Greater Dandenong Council Summary Table, with focus on sub-population vulnerability ranks and populations

Values	Bangholme	Dandenong	Dandenong North	Dandenong South	Keysborough	Lyndhurst (Vic.)	Noble Park	Noble Park North	Springvale (Vic.)	Springvale South
Minimum Temperature - Change from Baseline (%)	15.5%	16.2%	16.7%	15.9%	15.9%	15.4%	16.1%	16.6%	16.1%	16.2%
Maximum Temperature - Change from Baseline (%)	10.7%	10.6%	10.8%	10.7%	10.5%	10.6%	10.5%	10.7%	10.4%	10.4%
Extreme Temperature at 1% AEP - Change from Baseline (%)	6.5%	6.6%	6.8%	6.5%	6.4%	6.5%	6.4%	6.7%	6.4%	6.4%
Heat Wave, 3 or more Days above 35 (Days) - Change from Baseline (%)	175.9%	159.4%	200.0%	176.2%	282.7%	184.2%	188.0%	187.9%	195.9%	145.5%
Maximum Temperature above 35 (Days) - Change from Baseline (%)	111.8%	111.0%	119.6%	112.3%	122.8%	109.0%	104.3%	113.8%	104.7%	94.1%
Heat Health at 30C (Days) - Change from Baseline (%)	334.5%	341.4%	416.7%	339.4%	326.1%	347.2%	340.4%	402.3%	335.6%	341.3%
Total Annual Rainfall - Change from Baseline (%)	-9.0%	-8.5%	-7.6%	-8.7%	-8.3%	-8.9%	-7.8%	-7.6%	-7.8%	-7.5%
Standard Percipitation Index - Change from Baseline (%)	69.9%	75.4%	81.2%	67.1%	77.3%	62.2%	80.5%	81.5%	80.7%	82.4%
Extreme Rainfall at 1% AEP - Change from Baseline (%)	0.9%	1.8%	2.5%	1.6%	2.1%	0.6%	2.1%	2.4%	2.2%	2.2%
Sea Level Rise at 20cm - Coverage (%)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Sea Level Rise at 47cm - Coverage (%)	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Sea Level Rise at 82cm - Coverage (%)	0.2%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%
Sea Level Rise at 20cm with 1% AEP Storm Event - Coverage (%)	0.3%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%
Sea Level Rise at 47cm with 1% AEP Storm Event - Coverage (%)	1.6%	0.0%	0.0%	0.1%	0.0%	0.4%	0.0%	0.0%	0.0%	0.0%
Sea Level Rise at 82cm with 1% AEP Storm Event - Coverage (%)	11.2%	0.0%	0.0%	0.6%	0.0%	1.7%	0.0%	0.0%	0.0%	0.0%
Flood Extent in 1/100 yr Event - Coverage (%)	32.0%	4.9%	7.7%	17.0%	6.4%	28.8%	1.4%	10.6%	5.4%	3.9%
Combined Flooding and Storm Event (SLR 82cm, 1% AEP) - Coverage (%)	35.6%	4.9%	7.7%	17.1%	6.4%	28.9%	1.4%	10.6%	5.4%	3.9%
Fire - Bushfire Management Overlay Cover (%)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

A
B

Figure 2: Screenshot of Greater Dandenong Council Summary Table, with focus on climate indicators

Step 5: More Detailed Data Exploration (tabular data)

For the purposes of this worked example, we will explore the excel called: *Vulnerability_Climate_Combined_Values_MASTER_v2.xlsx*

Figure 3 presents a summarised view of the “Pivot Top 10” tab from within the excel document. The pivot table fields were chosen based on particular interests relevant to the case study, and then filtered to the top 4 suburbs based on the High Care Rank field.

****Hint:** don't forget to 'clean' the data after you choose the relevant fields (ie columns):

- “Summarize field by” (by right clicking field name): choose the correct average/sum/count based on the field type (e.g. Ranks will be averages, Populations will be sums, Libraries etc will be sums, Climate absolute figures will be averages, Climate % change from baseline will be averages, etc)
- The values always default to percentages. If you're not looking at a % value (e.g. population, rank, count of assets), highlight the values in the column you're cleaning and change the cell type to 'General' or "Number"
- If you'd like, you can remove or re-do the conditional formatting colours (e.g. In Figure 3 we have removed the conditional formatting colours and manually coloured the most important cell in the table)

****Hint:** to filter the suburbs by 'top 3' or 'top 5' etc, firstly clear all filters on the suburb column (right click), then select "Value Filters" and choose which filter to apply ('Top 10' lets you choose how many suburbs to filter, ie top 1/2/3/4....).

Insights from this data exploration within the Top 10 tab include:

- The most vulnerable suburbs in relation to 'high care' are Bangholme, Dandenong South, Noble Park and Noble Park North (in support of finding in Step 4).
- Although Noble Park has lower average vulnerability rankings (although still in top 4), it has very high populations of those who need assistance and those aged 65 and over.
- None of these top 4 suburbs have a library for the community to take refuge from the heat, although all do have at least one community centre/hall
- Almost 40% of the population in Noble Park and Noble Park North had different addresses 5 years ago – indicating they may not be as experienced with the local climate and hot weather extremes
- Noble Park North and Noble Park North are well serviced by public transport, meaning that there may be more attendance to the workshops if more people from these areas can reach the workshop location
- Residences in Bangholme may be more vulnerable in heat events as they have less access to public transport.

Suburb	Average of High Care - Rank	Average of Age 65 Over - Rank	Sum of Needs Assistance - Population	Sum of Age 65 Over Population	Average of General Health - Health Care Card (density by SA2)	Sum of Library - Count	Sum of Community Centres and Halls - Count	Average of Experience - Different Address from 5 Year Ago (density)	Average of Public Transport - Any mode within 400m
Bangholme	9.5	7.0	118	493	12.7%		2	22.3%	23.7%
Dandenong South	9.0	6.7	18	70	16.2%		1	37.9%	54.8%
Noble Park	6.9	5.8	2104	5220	7.0%		5	37.5%	87.4%
Noble Park North	6.9	5.4	494	1433	6.1%		1	23.6%	96.6%

Figure 3: 'Top 10' tab in the *Vulnerability_Climate_Combined_Values_MASTER_v2.xlsx* spreadsheet, filtered to highlight key vulnerable suburbs and relevant indicators

Creating Graphs from Tabular Data

The tabular data can be used to create different types of graphs. Graphs are a good way of visualising data and can be a useful addition to Business Cases.

Suggestions when making graphs from the tabular data include:

- Use the 'Pivot Sandbox' tab in the 'Vulnerability_Climate_Combined_MASTER_v2' table to choose which variables you want to represent on the graph (or use the Council Summary table if it already has the variables you want to represent)
- Once you have cleaned the data (**very important! See hints on above page**), it is suggested to select the table then Copy & Paste it to a NEW excel spreadsheet. This ensures that you don't change any of the pre-set formulars or accidently edit the data.

Hint: when pasting, right click and select 'paste as values' – this ensures that you paste the actual values instead of the excel formula.

A handy graph that can be created from excel is the 'combination graph'. This graph allows you to present multiple types of data on the one graph. It is most helpful (for example) to present suburbs on the X-axis, Vulnerability ranks on the primary Y-axis as bar graphs, and % values on the secondary graph as a line graph.

To clean up the below table in preparation for creating a combination graph (Figure 4), the following steps are suggested (after copying across the data into a new excel):

- Deleted any variables not wanted
- Transposed the data so that columns were the Suburb names
- Used 'Ctrl Find & Replace' to remove the 'Average of ', 'Sum of ' and 'Count of' from the variable headings (e.g. so that it reads "Age 65 Over – Rank" instead of "Average of 65 Over – Rank")
- Made sure decimal places made sense (e.g. 1 or 2 decimal places)
- Made sure % variables had their type changed to percentages

	Bangholme	Dandenong	Dandenong Nc	Dandenong So	Keysborough	Lyndhurst	Noble Park	Noble Park No	Springvale Sou	Springvale
Age 65 Over - Rank	7.0	6.3	5.3	6.7	4.3	5.0	5.8	5.4	4.9	5.7
Age 85 Over - Rank	5.0	4.0	3.4	1.0	3.6	1.0	4.4	3.8	3.5	4.6
High Care - Rank	9.5	5.1	6.3	9.0	4.6		6.9	6.9	3.2	3.8
Age 65 Over Population	493	3854	4234	70	4115	25	5220	1433	2160	3651
Age 85 Over Population	68	583	539	7	415	4	768	107	230	633
Needs Assistance - Population	118	2050	1508	18	1219		2104	494	771	1428
Rented Public - Population		551	402	6	87		456	130	104	84
Mean Annual Income Percentile Bracket	39%	36%	39%	33%	48%	44%	38%	38%	41%	36%
Heat Wave, 3 or more Days above 35 (Days) - Change from Baseline (%)	175.9%	159.4%	200.0%	176.2%	282.7%	184.2%	188.0%	187.9%	195.9%	145.5%
Maximum Temperature above 35 (Days) - Change from Baseline (%)	111.8%	111.0%	119.6%	112.3%	122.8%	109.0%	104.3%	113.8%	104.7%	94.1%
Heat Health at 30C (Days) - Change from Baseline (%)	334.5%	341.4%	416.7%	339.4%	326.1%	347.2%	340.4%	402.3%	335.6%	341.3%
Public Transport - Train Station Count		1					3			1
Public Transport - Bus Stop Count	18	237	105	103	98	16	83	44	52	85
Library - Count		1			2					2
Community Centres and Halls - Count	2	7	1	1	2	1	5	1	2	10
Aged Care and Residences - Count	1	12	6		6		12	1	3	5
General Health - Health Care Card (density by SA2)	12.7%	9.9%	7.2%	16.2%	5.8%	16.2%	7.0%	6.1%	7.6%	6.7%
General Health - Cardiovascular Disease (density)	8.5%	3.0%	3.7%	3.4%	2.7%	4.5%	2.8%	3.5%	2.5%	2.3%
General Health - Respiratory Condition (density)	10.1%	4.6%	6.4%	3.8%	5.9%	3.4%	6.0%	7.3%	6.3%	5.1%

Figure 4: screenshot of 'cleaned' excel table in preparation for making graphs

To create a combination graph, simply highlight the rows you want to present, and insert a 'combo graph'. Adjust settings to format it in the way you prefer. The two graphs below are examples of the types of graphs possible.

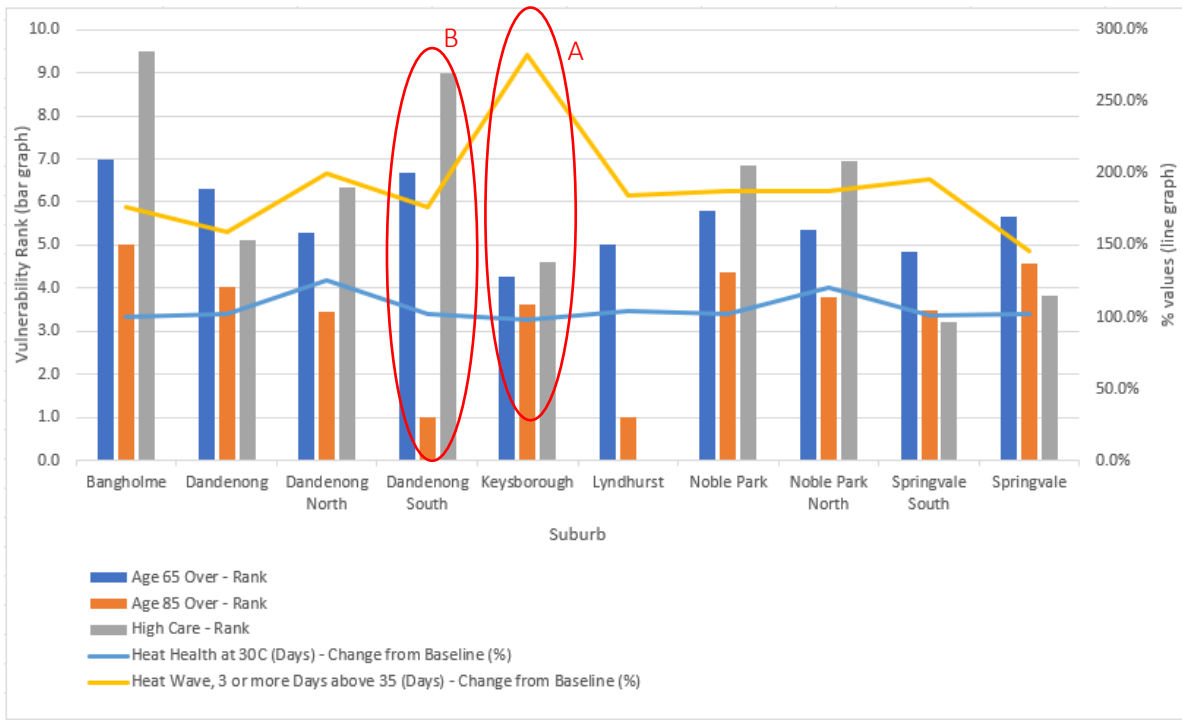


Figure 5: Combination graph showing vulnerability ranks and climate variables

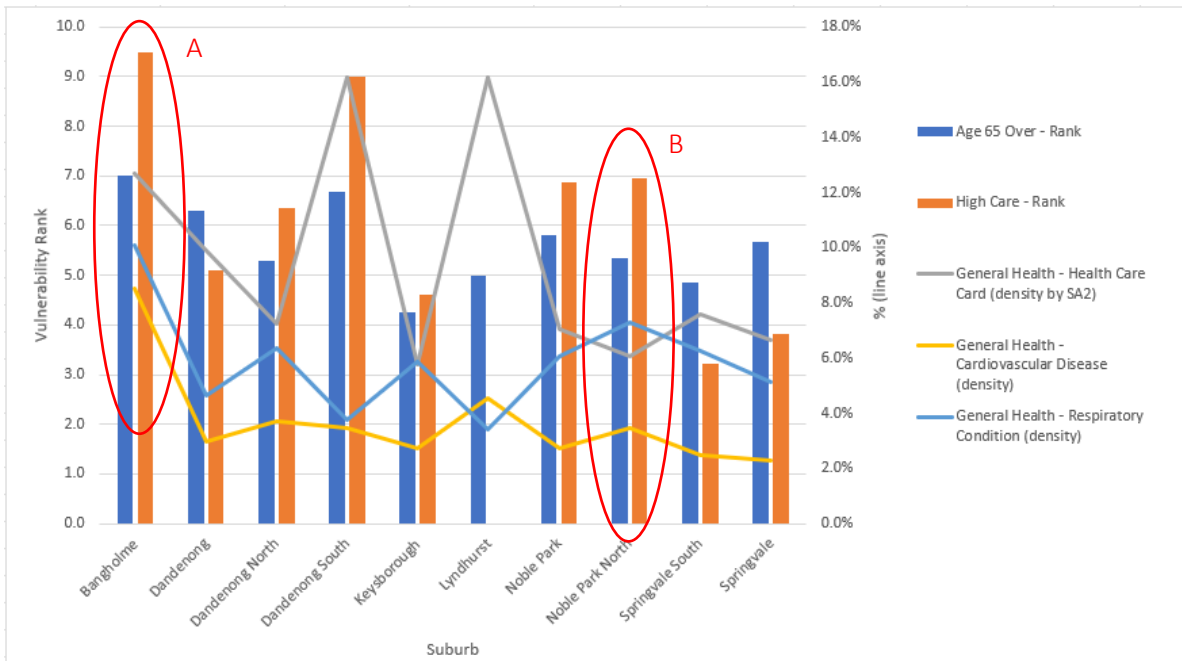


Figure 6: Combination graph showing vulnerability ranks and general health indicators

From the above graphs, insights highlighted include:

- Although Keysborough is likely to expect the highest increase in Heat waves into 2050, it has generally low rankings of vulnerability for those aged 65 and over, 85 and over, and those requiring assistance (Figure 5, A).
- Dandenong South has a high vulnerability ranking for those 65 and over, and for those needing assistance, but not for those aged 85 and over (Figure 5, B). This could be due to there being a high number of aged care residences in Dandenong South (Figure 4).
- Bangholme has high vulnerability rankings for those aged 65 and over and for those requiring assistance, and has proportionately high general health indicators (Figure 6, A)
- Noble Park North has a high vulnerability ranking of those who require assistance, and a high proportion of the population that suffers from a respiratory condition (Figure 6, B).

Step 6: Exploring Spatial Data (QGIS Viewer)

Exploring the data in the QGIS provides a more detailed and granular detail.

QGIS Climate Viewer

The QGIS Climate Viewer can be used to explore the climate futures at a regional level. The QGIS Climate Viewer provides projection data for 3 GCMs, 2 RCP scenarios and 4 timeframes, and the 'current/baseline' data that these projections are based on (refer to Project reports for further information). It also provides decadal historic data from the 1970s to 2010s if you wanted to see trends over the last 5 decades.

For this worked example, we will look at Heat Stress, and how it's expected to change over the near to mid futures (2030, 2050 & 2070).

Heat Stress Days represent the number of annual days where the minimum temperature doesn't go below 20°C and the maximum temperature is above 35°C. This is an important consideration in relation to older people and those who require care, as the higher night time temperatures in addition to the day time extremes places stress on the body, especially for those who are already vulnerable with underlying health conditions.

Table 1: Heat Stress Days (annual) projections for 2030, 2050 & 2070 under a "hotter and dryer" (HadGEM2-CC) climate future at RCP 4.5

	Baseline (1981-2010)	2030	2050	2070
Dandenong area*	1.3 days/yr	+1.9 days/yr more than baseline (i.e. 3.2 days/yr)	+ 2.4 days/yr more than baseline (i.e. 3.7 days/yr)	+ 3.0 days/yr more than baseline (i.e. 4.3 days/yr)
Noble Park/Noble Park North area*	1.3 days/yr	+1.9 days/yr more than baseline (i.e. 3.2 days/yr)	+ 2.3 days/yr more than baseline (i.e. 3.6 days/yr)	+ 2.8 days/yr more than baseline (i.e. 4.1 days/yr)

*Note that these we've noted 'area' as the climate grids are 5km².

Table 1 highlights:

- In both the Dandenong and Noble Park/Noble Park North areas, the number of Heat Health days will increase to above 4 days per year, up from current at 1.3 days per year, under a hotter and dryer climate future at RCP 4.5.

QGIS Minderoo Data Viewer

The QGIS Minderoo Data Viewer provides the same information as the tabular data, with the exception that it's presented at the SA1-level and in spatial format. Benefits of interrogating data in this format is that hotspots are better identified, and a user can investigate the data to see the factors driving a higher vulnerability score.

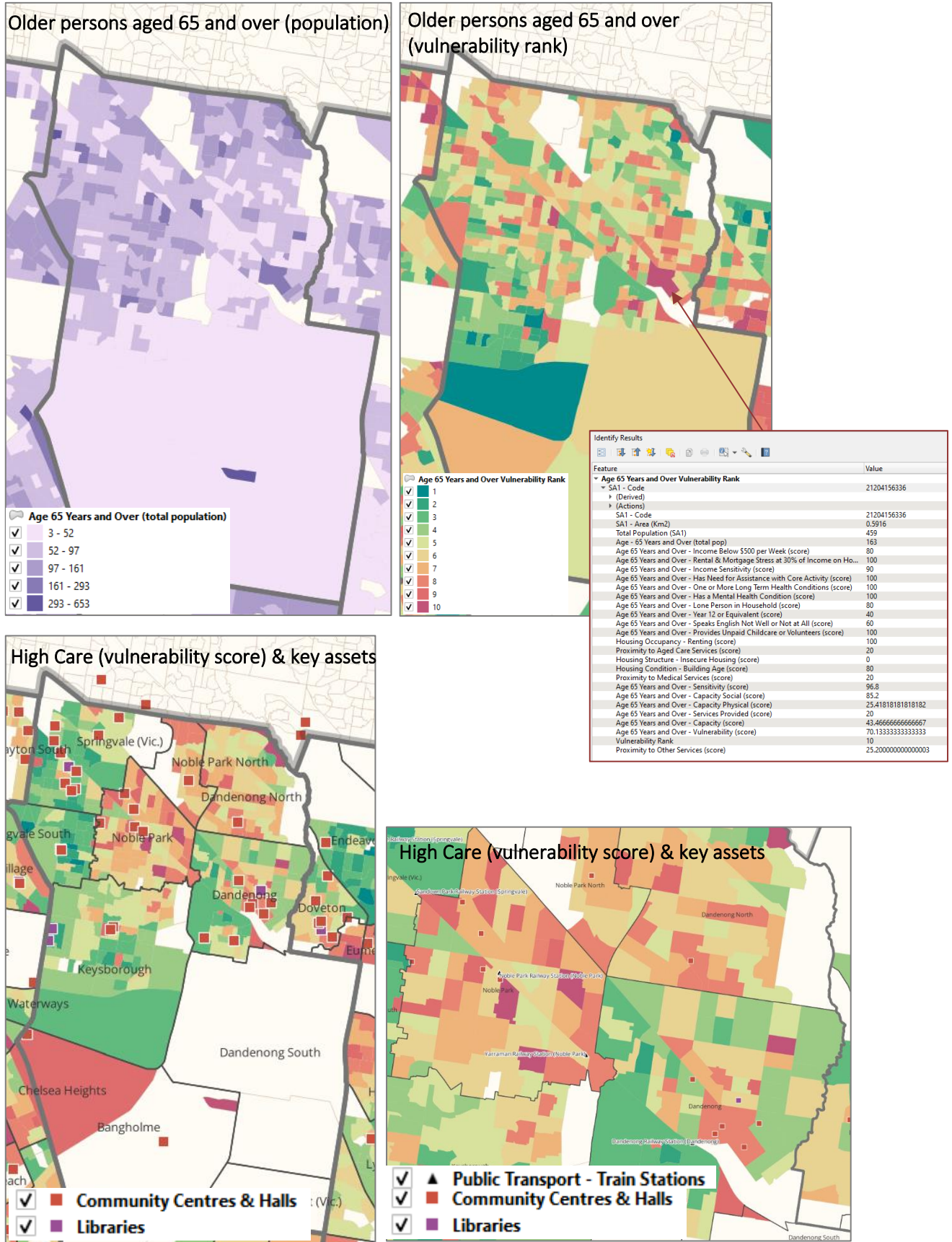


Figure 7: Screenshots of the QGIS Viewer

Findings from the QGIS Data exploration include (referring to the figures above):

- Noble Pak and Dandenong have train stations in hotspots of increased High Care Vulnerability, and both have facilities that may be options to host workshops (Libraries and/or Community Halls)
- Noble Park North and Dandenong North have fewer publicly-accessible places of heat refuge. People living in these areas may be at a higher risk as they cannot easily access these places.
- The 'Identify Results' box in the above figure provides more information on the SA1 highlighted, and allows the user to see what's driving the high vulnerability ranking. This tells us that this SA1 area in Dandenong has a high scorings of most indicators such as *rent and mortgage stress, has need for assistance for most core activities, has one or more long term health conditions, has a mental health condition, etc.*

NOTE: the assets presented in the QGIS viewers are state-wide publicly available datasets (i.e. Vicmap data) and could therefore be missing some assets – if you would like to, you can add your Council's internally-held asset spatial data (and any other datasets you may hold internally that interests you to see in conjunction with this data).

Step 7: Developing Business Case

Based on the data interrogation undertaken, some potential locations to host informative heat-smart workshops are:

- **Noble Park, Noble Park North and/or Dandenong**
 - High vulnerabilities of High Care people across both suburbs, and high population of these sub-population
 - Has central Community Halls that are close to public transport, meaning program may have a larger outreach if more people have options to travel to workshop location
 - Proximity to the suburbs of concern - better access for those who need it the most

The information gathered in the above steps can be used within a business case to support justification.

