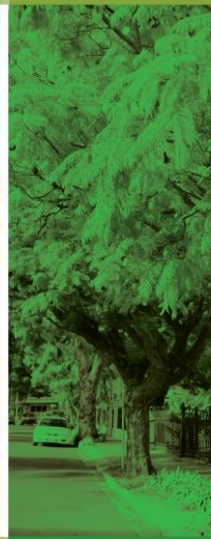
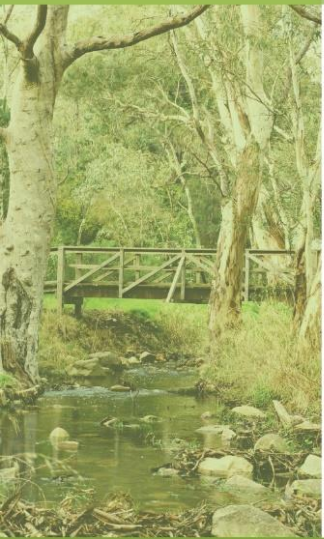


Resilient East

Integrated Vulnerability
Assessment Report



Resilient East Climate Change Adaptation Plan Project

Integrated Vulnerability Assessment Report

Lead Consultant URPS

In association with Seed Consulting Services
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Prepared for Resilient East

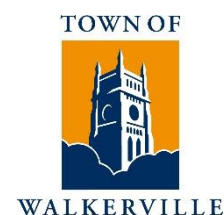
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City of
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Citation

Resilient East (2015) *Integrated Vulnerability Assessment Report*, prepared by URPS as part of the Resilient East consultancy led by URPS, for the Eastern Region in association with the Government of South Australia and the Australian Government.

Contents

| | | |
|-------|---|----|
| 1 | Introduction | 1 |
| 1.1 | Role of this report | 2 |
| 2 | What is an Integrated Vulnerability Assessment? | 3 |
| 2.1 | Identifying indicators for the IVA framework | 4 |
| 2.1.1 | Selection of climate variables | 5 |
| 2.2 | Implementing the IVA framework | 9 |
| 3 | Analysing the Integrated Vulnerability Assessment | 10 |
| 3.1 | Understanding the analysis of the IVA | 11 |
| 3.2 | Resilience and opportunities for the Region | 15 |
| 4 | Transitioning from the IVA to adaptation planning | 17 |
| 4.1 | Proposed areas of focus | 17 |
| 5 | Next steps | 21 |
| 6 | References | 22 |
| | Appendix A | 23 |
| | Appendix B | 25 |
| | Appendix C | 32 |

Executive Summary

Resilient East aims to develop a coordinated and collaborative response to reduce the vulnerability of metropolitan Adelaide's Eastern Region to climate change.

The Resilient East project is being undertaken by the Eastern Region Alliance (ERA) - a partnership between the Cities of Tea Tree Gully, Campbelltown, Burnside, Unley, Norwood Payneham & St Peters and Prospect, and the Town of Walkerville - together with Adelaide City Council.

As part of this process an Integrated Vulnerability Assessment (IVA) was undertaken for Resilient East to identify priority areas for focussing adaptation planning. The IVA assists with understanding how:

- Climate change may impact valued aspects or features in the Eastern Region; and
- Particular valued aspects or features may be more vulnerable than others to climate change.

The IVA was developed and implemented using a collaborative approach and involved participation by the project team (comprising consultants, Resilient East working group and steering group members) and stakeholders from across the Region.

Analysis of the IVA identified a series of indicators (refer Table 1) from which areas of focus have been identified for adaptation planning. This report documents the methodology used to complete the IVA, the approach to analysing the results of the IVA and the priority areas of focus for the third and final task of Resilient East relating to the preparation of the Regional Adaptation Plan.

Table 1 Indicators with higher vulnerability identified by the analysis of the IVA

| Indicators with Higher Vulnerability |
|--|
| Amenity and liveability of medium and high density residential areas |
| Amenity, character and recreation opportunities provided by Linear parks |
| Amenity, character, habitat, biodiversity and recreation opportunities provided by natural open space (eg Council reserves, DEWNR parks) |
| Community participation in outdoor community events, celebrations and activities |
| Condition and extent of native vegetation |
| Condition of Aboriginal heritage (natural heritage e.g. watercourses, natural wetlands) |
| Condition of natural watercourses (biodiversity and amenity) |
| Effective functioning and utilisation of public realm (built infrastructure) |
| Effective functioning of arts and cultural facilities (art galleries, libraries, theatres, community centres) |
| Effective functioning of stormwater management features (WSUD, wetlands, basins, pumps) |
| Effective operation of electricity supply network |
| Employment in the health care and social assistance sector |

| Indicators with Higher Vulnerability |
|---|
| Health, safety and wellbeing of vulnerable members of the community (people with disability) |
| Health, safety and wellbeing of vulnerable members of the community (those aged over 65) |
| Health, safety and wellbeing of vulnerable members of the community (CALD members of the community) |
| Low income individuals and/or families |
| Utilisation of open space |
| Wealth and vibrancy generated by major events |

Transitioning from the IVA to adaptation planning

Resilient East is using adaptation pathways analysis to prepare the Climate Change Adaptation Plan. An important step in undertaking this approach is to frame the areas of focus that have been identified by the analysis of the IVA as 'key areas of decision making'.

Key areas of decision making comprise questions that the Adaptation Plan is looking to respond to and are made up of the following elements:

- The objective of what the Region is looking to achieve in relation to an aspect of feature that is valued. For example, *provide, protect and manage*;
- The valued feature or aspect that the Region is focussed on. For example, the health, safety and wellbeing of vulnerable members of the community; and
- The reason why the Region needs to take action, i.e. in response to a particular climate impact such as increased frequency and intensity of heat waves.

For Resilient East, 8 key areas of decision making are proposed (refer Table 2).

Table 2 Resilient East key areas of decision making

| Theme | Proposed key area of decision making |
|---|--|
| Vulnerable members of the community (ie those needing assistance with core activities eg frail aged or people with a disability) | How do we improve the health, safety and wellbeing of vulnerable members of the community as the frequency and intensity of heat waves and bushfires increase? |
| Open and green spaces | How do we provide, protect and enhance the amenity, biodiversity and recreation opportunities provided by open space as our climate becomes warmer and drier and there is an increased risk of damage from heat waves and bushfires? |
| Natural landscapes | How do we protect and enhance the condition of natural landscapes across the plains and hills face as our climate becomes warmer and drier and the risk of extremes such as heat wave and bushfire increases? |

| Theme | Proposed key area of decision making |
|---|---|
| Urban areas | How do we create better amenity and liveability in our urban areas as our climate becomes warmer and drier and the risk of extremes such as heat wave and bushfire increases? |
| Activity centres (eg main streets and CBD environment) | How do we improve the amenity and vibrancy of our activity centres as our climate becomes warmer and drier and the risk of heat waves increase? |
| Stormwater management infrastructure | How do we design, construct and maintain stormwater management infrastructure so that it provides flood protection, maximises reuse opportunities and enhances amenity as annual rainfall declines, rainfall intensity increases and the risk of heatwaves rises? |
| Community participation (services, places and spaces) | How do we support and grow participation in events, celebrations and activities as rainfall intensity, frequency, intensity and duration of heat waves and bushfire risk increases? |
| Continuity of services | How do we minimise disruption to business, events and infrastructure and residents reliant on electricity as we are exposed to more frequent and intense heatwave and greater fire risk? |

Next steps

The third and final task of Resilient East will be to develop adaptation pathways for each of the key decision areas identified above. This will involve working with stakeholders via a two staged workshop process to develop adaptation pathway maps for each of the key areas of decision making. Once completed, the Climate Change Adaptation Plan will be prepared bringing together all relevant inputs from earlier project tasks and identifying key actions to be progressed in the Region.

1 Introduction

Resilient East aims to develop a coordinated and collaborative response to reduce the vulnerability of metropolitan Adelaide's Eastern Region to climate change.

The Resilient East project is being undertaken by the Eastern Region Alliance (ERA) - a partnership between the Cities of Tea Tree Gully, Campbelltown, Burnside, Unley, Norwood Payneham & St Peters and Prospect, and the Town of Walkerville - together with Adelaide City Council.

The project is being undertaken over three stages as summarised below and in Figure 1:

1. Development of a vision, values and summary of relevant regional characteristics and key decisions, and description of a future climate scenario as a basis for planning;
2. An Integrated Vulnerability Assessment (IVA) that considers the implications of climate change on the identified vision, values and key decisions; and
3. A Climate Change Adaptation Plan that documents both regional and individual Council actions to respond to vulnerabilities identified in the IVA.

This Integrated Vulnerability Assessment Report is the culmination of the second stage of work, and will underpin the final Adaptation Plan stage of the project.

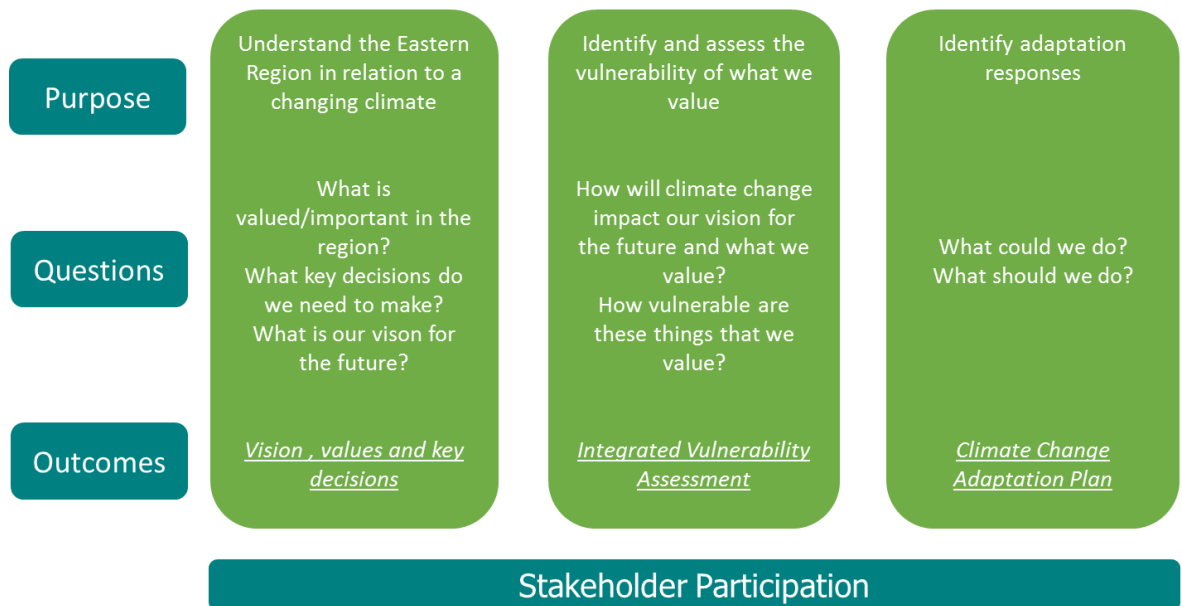
Resilient East involves the active participation of the Region's key stakeholders, players and influencers in order to provide a strong foundation for ongoing coordination and collaboration to tackle the challenges of climate change into the future. The three project stages incorporate a series of workshops involving representatives of organisations that play a role in the Region's:

- Assets and infrastructure;
- Emergency management;
- Local economic development and sustainability;
- Natural environment, open space and water; and
- Social and community resilience and health.

In this second stage, stakeholders have brought their perspectives and expertise from these sectors to contribute directly to the assessment of vulnerability of the Eastern Region to a changing climate.

Appendix A shows those organisations that have participated in Resilient East project to date.

Figure 1 Overview of Resilient East



1.1 Role of this report

This report is the culmination of work undertaken in stage two of Resilient East and utilises and builds on information collected in stage one documented in the following reports:

- Vision, Values and Key Decisions Report; and
- Climate Projections for the Eastern Adelaide Region Report.

This report summarises the Integrated Vulnerability Assessment (IVA) undertaken for Resilient East and documents:

- Methodology used to implement the IVA;
- Approach to analysing the results of the IVA; and
- Priority areas of focus for the third and final stage of Resilient East relating to the preparation of the Regional Adaptation Plan.

2 What is an Integrated Vulnerability Assessment?

An Integrated Vulnerability Assessment (IVA) helps to identify areas of vulnerability to the impacts of climate change. It is a tool that can assist with prioritising or identifying areas for focussing adaptation action.

The IVA is an evolution in purely risk based approaches to climate change adaptation because it considers both the potential impact of climate change (exposure and sensitivity) and adaptive capacity (refer Table 3 for definitions of these and other key terms used in this section).

Table 3 Definitions of key terms

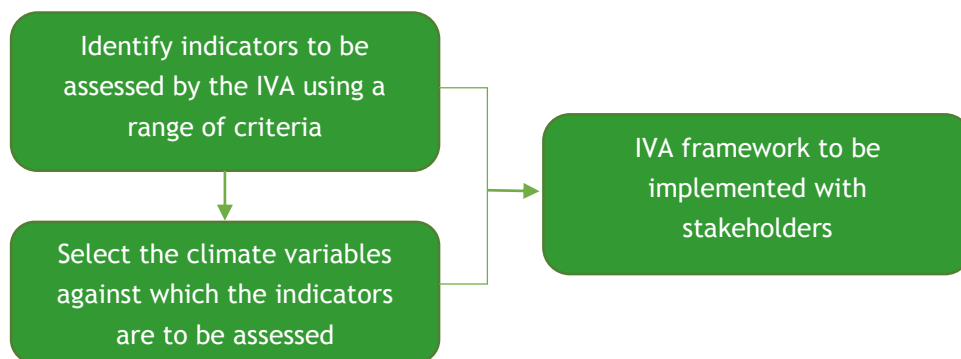
| Term | Definition |
|---|--|
| Climate variable | Climate variables are the different climate factors such as rainfall and temperature that determine the climate. Changes in these are projected to occur as a result of climate change including declining rainfall, increasing rainfall intensity, increasing average temperature, increasing frequency and intensity of heatwaves and increasing fire risk. |
| Exposure | Exposure considers the likelihood of a feature or its function being subjected to change in a particular climate variable. For example low lying land is more exposed to inundation from flooding, the entire Region is exposed to heatwaves and the Hills Face area is exposed to bushfire. For Resilient East, exposure relates to predicted changes in the climate at 2050. |
| Sensitivity | Sensitivity considers the degree to which a feature or its functions are affected by change to a particular climate variable. For example, older people are more sensitive to heatwaves, non-irrigated open space is sensitive to reduced rainfall and native vegetation is sensitive to increased bushfire risk. |
| Adaptive capacity (to cope with 2050 conditions) | Adaptive capacity is the ability of a feature or function to adjust to climate change impacts (including climate variability and extremes) to moderate potential damages, take advantage of opportunities, or cope with consequences and maintain the valued characteristics of that feature or function. Consideration is given to what extent a feature or its function in its current form, with current management practices or funding, able to continue to function, cope or adjust to the expected climate conditions at 2050. For example, water sensitive urban design (WSUD) can provide the ability for a streetscape to function in response to reduced rainfall, but if no WSUD measures are in place now, then the adaptive capacity would be considered to be less than if WSUD was currently in place. |

The IVA framework used for Resilient East was developed drawing on the *Climate Adaptation Planning Guidelines* prepared by the Local Government Association¹.

¹ Local Government Association of South Australia (2014) *Climate Adaptation Planning Guidelines*

Developing the IVA framework involved two key steps as summarised by Figure 2 Key steps to developing the IVA framework and described in more detail below.

Figure 2 Key steps to developing the IVA framework



2.1 Identifying indicators for the IVA framework

The first step in developing the IVA framework is to identify the indicators for which exposure, sensitivity and adaptive capacity to climate change are to be considered.

Indicators were identified with reference to the values identified by stakeholders in Stage One of Resilient East. These values comprise:

- Open and green spaces;
- Water;
- Community engagement, education and participation;
- Community connection, inclusion;
- Health, wellbeing and safety;
- Habitat and biodiversity;
- Governance;
- Infrastructure and built environment; and
- Economic activity and vibrancy.

To identify the indicators to be assessed by the IVA, consideration was given to those aspects or features that contribute to the identified values. Many of those aspects or features identified contribute to multiple values reflecting the integrated nature of the assessment process.

In total 36 indicators were assessed by the Resilient East IVA and are listed in Appendix B. Appendix B also shows the relationship of each indicator to the Resilient East values.

2.1.1 Selection of climate variables

The second step in developing the IVA framework involves identifying the climate variables to be used in the assessment of the indicators.

Climate variables describe various aspects of the future climate such as:

- Maximum and minimum temperature;
- Extreme heat;
- Quantity and seasonality of rainfall;
- Intensity of extreme rainfall events; and
- Frequency and intensity of extreme fire danger days.

The description of such variables relies on choosing a climate projection, which indicates the expected trend in climate variables under various emissions scenarios and the quantum of change.

In determining what projection was to be used, three key factors were considered:

- Emissions scenario (e.g. low, medium or high);
- Climate model output (e.g. median or 90 percentile results); and
- Year of the projection (2030, 2070 or 2100).

For the Resilient East project it was agreed by the Project Steering Committee that the climate variables used by the IVA be based on the following:

- High concentration pathway (formerly known as high emissions scenario - selected as global emissions are currently tracking on this pathway);
- Median model output; and
- Timeframe of 2050 - selected to balance the need to incorporate a timeframe that reflected longer term decisions (e.g. asset delivery lifecycle considerations) and a timeframe that is not beyond reasonable and realistic timeframes to strategic planning for the Region's organisations.

Table 4 summarises the climate variables used by the Resilient East IVA².

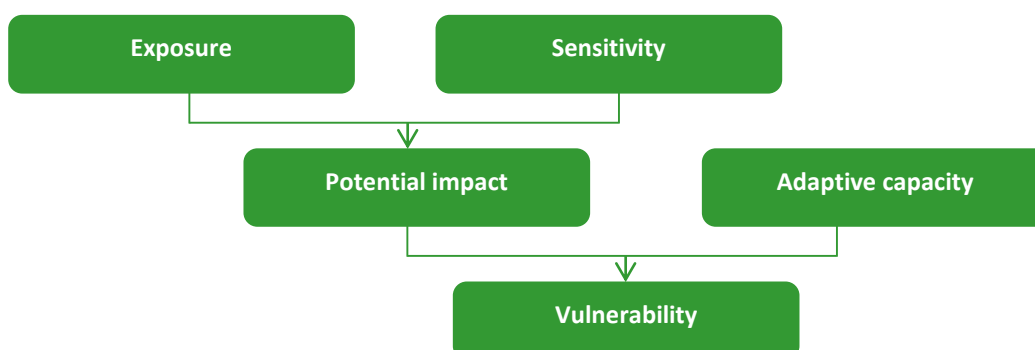
Table 4 Climate variables used by the IVA

| Climate variable | Description (change by 2050-high emissions) |
|---|--|
| Temperature - increase average | 1.6°C increase in average annual maximum temperature |
| Heatwaves - increased frequency and intensity | 2 or more days over 35°C will more than double |
| Rainfall - declining annual average | 7.4% reduction in average annual rainfall |
| Rainfall - declining Spring | 21% reduction |
| Rainfall intensity - increasing | 10% increase in extreme daily rainfall |
| Fire risk - increasing | Days of extreme fire risk will increase 5 fold by 2070 ³ |
| Temperature - increased summer and autumn | 1.5-1.6°C increase in average maximum temperature in summer and autumn |
| Temperature - increased winter and spring | 2°C increase in average maximum temperature in winter and spring |

To complete the IVA, scores are assigned to how exposed a feature or function is to a climate variable (e.g. increased heatwave frequency and intensity or sea level rise) and how sensitive that feature or function is to that exposure. The potential impact is determined by assessing exposure plus sensitivity.

Vulnerability is then identified by considering potential impact in relation to the adaptive capacity of the feature or its function to cope or adjust. Figure 3 shows how exposure, sensitivity, potential impact and adaptive capacity are all considered in the evaluation of vulnerability to a defined climate change variable. Box 1 provides more detail about how vulnerability is calculated.

Figure 3 Integrated Vulnerability Assessment



² Refer to the Resilient East (2015) *Climate Projections Report*, for more detail

³ Note that data is not available for 2050 in relation to this variable.

Box 1 Calculating vulnerability using the IVA framework

The IVA is set up in Excel, and provides the framework for assessing the indicators.

Each indicator is assessed for exposure (score out of 5) and sensitivity (score out of 5) to calculate potential impact (score out of 10). Adaptive capacity is then assessed (score out of 10).

Vulnerability is determined using the following formula to provide a score out of 19:

$$\text{Vulnerability} = \text{Potential impact} - \text{Adaptive Capacity} + 10 = \text{score out of 19}$$

Figure 4 shows how the IVA framework is used to assess an indicator. In this example the indicator is 'community participation in outdoor community events, celebrations and activities' and the climate variable is 'heat wave-increased frequency and intensity'.

It should be noted that not all climate variables are relevant to each indicator (e.g. sea level rise is not relevant to the Eastern Region for any indicators, reduced rainfall is relevant to natural landscapes but not relevant to demand for emergency services), and an initial step in implementing the IVA framework involves identifying those climate variables that are relevant to the indicator being considered. Appendix C shows the climate variables relevant to each of the indicators assessed in the IVA.

Figure 4 Example of how the IVA framework assesses an indicator

| Indicator: Community participation in outdoor community events, celebrations and activities | | | | | | | |
|---|----------------|-------------------|---|------------------------|-------------------------|---|---------------------|
| Climate variable | Exposure score | Sensitivity score | Comment | Potential impact score | Adaptive capacity score | Comment | Vulnerability score |
| Heat wave-increased frequency and intensity | 5 | 4 | Events may have to be rescheduled or cancelled if coincide with heat waves, people will not participate in hot weather, heat felt across entire region People with children or elderly more sensitive to heat, younger populations less sensitive and likely to go to evening events | 9 | 6 | Some events can use cooling tents, provide water, can move events later in day, can't stop a bushfire but can provide shade and cooling to make conditions more comfortable, shade areas like at Thorndon Park, TDU moved end to irrigated and shaded area makes better conditions Already had to deal with heat waves in recent times, included in event planning, site choice etc. Private event operators may be less prepared, heat may be included in risk management but decision making on the day may not be as well prepared Summer events already usually planned for evenings | 17 |

A score out of 5 is assigned to how exposed the indicator is to a climate variable (in this example heatwave)

A score out of 5 is assigned to how sensitive the indicator is to a climate variable (in this example heatwave)

Comments are recorded to assist with understanding how the score has been assigned

Exposure and sensitivity score added to give a score out of 10

A score is assigned out of 10 for adaptive capacity

Vulnerability score is potential impact minus adaptive capacity plus 10 to give a score out of 19

2.2 Implementing the IVA framework

Once the IVA framework for Resilient East was developed, the next step involved its implementation.

The IVA was implemented over two phases as follows:

- Phase 1-‘First pass’ assessment. This process involved the project team (comprising Resilient East project consultants and working group members) undertaking a ‘first pass’, preliminary assessment. Given the complexity and volume of information required to be assessed by the IVA it was considered that undertaking a first pass assessment would aid the discussion with stakeholders. The first pass assessment focused on scoring exposure and sensitivity.
- Phase 2-Involvement of stakeholders. This process involved working with stakeholders to confirm, refine and add to the ‘first pass’ assessment, in particular scoring the adaptive capacity of the indicators.

Three workshops were structured around the following themes:

- Community wellbeing and economic prosperity;
- Planning, assets and infrastructure; and
- Environment, water and the public realm.

The complete results of the implementation of the IVA framework are provided in Appendix C.

3 Analysing the Integrated Vulnerability Assessment

The IVA is a tool that can assist with understanding those aspects or features of the Eastern Region that may be more vulnerable than others to the impacts of climate change and enables the identification of priority areas to focus adaptation planning in the Region.

In order to understand what areas to focus adaptation planning on in the next stage of Resilient East, the IVA must be analysed to identify indicators with higher vulnerability. There are a range of ways to analyse the IVA and this section of the report summarises the approach undertaken for Resilient East.

For Resilient East the indicators with an average vulnerability score of 15 and over or a maximum individual vulnerability score of 17 and over were identified. This approach recognises that in averaging vulnerability scores for individual indicators with multiple climate variables, specific higher vulnerabilities can be masked.

For example, the indicator *community participation in outdoor community events, celebrations and activities* was assessed against 5 different climate variables (increasing fire risk, increasing heatwaves, declining spring rainfall, increasing rainfall intensity and increasing summer and autumn temperatures) resulting in 5 vulnerability scores. These scores ranged from 9 to 17, with an average of 12.4. If only the average scores were considered in the analysis, this indicator would not be identified as having higher vulnerability. By deploying the approach to analysis described above, this higher vulnerability of community participation to increased fire risk is identified.

Table 5 shows the results of this analysis.

Table 5 Results of IVA analysis

| Indicators with Higher Vulnerability - Average vulnerability score of 15 and over OR a maximum individual vulnerability score of 17 and over |
|---|
| Amenity and liveability of medium and high density residential areas |
| Amenity, character and recreation opportunities provided by Linear parks |
| Amenity, character, habitat, biodiversity and recreation opportunities provided by natural open space (eg Council reserves, DEWNR parks) |
| Community participation in outdoor community events, celebrations and activities |
| Condition and extent of native vegetation |
| Condition of Aboriginal heritage (natural heritage e.g. watercourses, natural wetlands) |
| Condition of natural watercourses (biodiversity and amenity) |
| Effective functioning and utilisation of public realm (built infrastructure) |
| Effective functioning of arts and cultural facilities (art galleries, libraries, theatres, community centres) |
| Effective functioning of stormwater management features (WSUD, wetlands, basins, pumps) |

| |
|---|
| Indicators with Higher Vulnerability - Average vulnerability score of 15 and over OR a maximum individual vulnerability score of 17 and over |
| Effective operation of electricity supply network |
| Employment in the health care and social assistance sector |
| Health, safety and wellbeing of vulnerable members of the community (people with disability) |
| Health, safety and wellbeing of vulnerable members of the community (those aged over 65) |
| Health, safety and wellbeing of vulnerable members of the community (CALD members of the community) |
| Low income individuals and/or families |
| Utilisation of open space |
| Wealth and vibrancy generated by major events |

3.1 Understanding the analysis of the IVA

Based on the analysis documented in section 3 the indicators with higher vulnerability and their associated features or aspects have been grouped under common themes. Table 6 summarises this process and identifies the following for each theme:

- Indicators relevant to the theme;
- Other related indicators that did not come through in the analysis, but nevertheless relate to the identified theme ; and
- Key climate variables that the key features and aspects that are valued are vulnerable to.

Table 6 Themes by indicators and key climate variables

| Theme | Relevant Priority Indicators from IVA analysis | Key climate variables that score higher for vulnerability | Other related indicators |
|---|---|--|---|
| Vulnerable members of the community (ie those needing assistance with core activities eg frail aged or people with a disability) | <p>Employment in the health care and social assistance sector</p> <p>Health, safety and wellbeing of vulnerable members of the community (people with disability)</p> <p>Health, safety and wellbeing of vulnerable members of the community (those aged over 65)</p> <p>Health, safety and wellbeing of vulnerable members of the community (CALD members of the community)</p> <p>Low income individuals and/or families</p> | <p>Increased frequency and intensity of heatwaves</p> <p>Increased fire risk</p> | <p>Meeting demand for emergency services</p> <p>Rates of volunteering in the community</p> |
| Open space | <p>Utilisation of open space</p> <p>Amenity, character, habitat, biodiversity and recreation opportunities provided by natural open space (e.g. Council reserves, DEWNR parks)</p> <p>Amenity, character and recreation opportunities provided by Linear parks</p> <p>Wealth and vibrancy generated by major events</p> | <p>Increased temperatures</p> <p>Reduced rainfall</p> <p>Increased frequency and intensity of heatwaves</p> <p>Increased fire risk</p> | <p>Amenity, character, recreation and event opportunities provided by Adelaide Park Lands</p> <p>Amenity, character and recreation opportunities provided by irrigated open space</p> <p>Effective functioning of walking and cycling paths</p> |
| Natural landscapes | <p>Condition and extent of native vegetation</p> <p>Condition of natural watercourses (biodiversity and amenity)</p> <p>Amenity, character and recreation opportunities provided by Linear parks</p> <p>Amenity, character, habitat, biodiversity and recreation opportunities provided by natural open space (e.g. Council reserves, DEWNR parks)</p> <p>Condition of Aboriginal heritage (natural heritage e.g. watercourses, natural wetlands)</p> | <p>Increased temperatures</p> <p>Reduced rainfall</p> <p>Increased frequency and intensity of heatwaves</p> <p>Increased fire risk</p> | |

| Theme | Relevant Priority Indicators from IVA analysis | Key climate variables that score higher for vulnerability | Other related indicators |
|---|--|---|---|
| Urban areas | Amenity and liveability of medium and high density residential areas Low income individuals and/or families Effective functioning and utilisation of public realm (built infrastructure) | Increased temperatures Reduced rainfall Increased frequency and intensity of heatwaves Increased fire risk | Amenity, character and shelter/comfort provided by public realm (street trees and landscaped streetscapes) Thermal performance of housing (comfort levels for tenants and reduce impacts for heat waves) Amenity and liveability of low density residential areas |
| Activity centres (eg main streets and CBD environment) | Effective functioning and utilisation of public realm (built infrastructure) Amenity and liveability of medium and high density residential areas | Increased temperatures Reduced rainfall Increased frequency and intensity of heatwaves | Effective functioning, viability and vibrancy of retail and commercial centres |
| Stormwater management infrastructure | Effective functioning of stormwater management features (WSUD, wetlands, basins, pumps) | Reduced rainfall Increased rainfall intensity Increased frequency and intensity of heatwaves | Meeting demand for emergency services |
| Community participation (services, places and spaces) | Community participation in outdoor community events, celebrations and activities Effective functioning and utilisation of public realm (built infrastructure) Effective functioning of arts and cultural facilities (art galleries, libraries, theatres, community centres) Wealth and vibrancy generated by major events | Increased rainfall intensity Increased frequency and intensity of heatwaves Increased fire risk | Rates of volunteering in the community |

| Theme | Relevant Priority Indicators from IVA analysis | Key climate variables that score higher for vulnerability | Other related indicators |
|-------------------------------|--|---|--|
| Continuity of services | Effective operation of electricity supply network Wealth and vibrancy generated by major events | Increased frequency and intensity of heatwaves Increased fire risk | Effective functioning, viability and vibrancy of retail and commercial centres Effective operation of CWMS wastewater treatment network (e.g. pipes and pumps) Effective operation of potable water supply (e.g. pipes and pumps) and treatment plants Effective operation of SA Water wastewater treatment network (e.g. pipes and pumps) Effective operation of road network |

3.2 Resilience and opportunities for the Region

Although the IVA is focused on understanding those aspects that might be particularly vulnerable to the impacts of climate change, the analysis of the IVA also identified a number of aspects which have lower vulnerability than others.

Indicators can have lower vulnerability for a combination of one or more of the following reasons; they have low exposure scores, low sensitivity scores or high adaptive capacity scores. However, if the indicator being considered may benefit from a given climate impact (i.e. exposure to a climate variable presents an opportunity to enhance or increase the condition of a feature or aspect that is valued), this can also be reflected by assigning a low sensitivity score or high adaptive capacity score. Hence, low vulnerability could be as a result of either resilience or an opportunity. It should be noted that where a feature or aspect is not expected to be affected by a climate variable (i.e. will have very low sensitivity) it is not assessed against that variable during the IVA.

Examples of aspects or features in the Region that have lower vulnerability scores for particular climate variables include:

- Rates of volunteering in the community has low sensitivity overall to increased frequency and intensity of heatwaves and increased rainfall intensity and has high adaptive capacity as it was suggested that people do not consider climate when determining if they will volunteer or not, however, volunteering for one off or individual events may be impacted if they coincide with a heatwave;
- The effective operation of potable water supply (e.g. pipes and pumps and treatment plants) is less sensitive to increasing rainfall intensity and has high adaptive capacity due to current consideration of climate change impacts on water quality and SA Water asset management planning;
- The effective operation of CWMS wastewater treatment network (e.g. pipes and pumps) has low sensitivity to declining average rainfall and has high adaptive capacity as it was identified that such systems operate better under such conditions as there will be less stormwater entering the treatment operations;
- The amenity, character recreation and event opportunities provided by the Adelaide Park Lands has high adaptive capacity with respect to increased frequency and intensity of heatwaves due to access to GAP (recycled) water, funding in place to replant drought tolerant species and the Park Lands Management Strategy which considers the impacts of climate change;
- The effective operation of government owned built assets such as schools and community, sporting and recreational facilities has higher adaptive capacity associated with funding for asset management and replacement and higher priority for government spending;

- The effective operation of SA Water wastewater treatment network (e.g. pipes and pumps) has high adaptive capacity in relation to increasing fire risk due to bushfire management plans, backup generators at pumping stations, the ability to divert the sewer network, options such as replacing pumps or manual cartage, and the fact that the majority of the Region is serviced by a gravity fed sewer network.

The following opportunities were identified through the IVA process:

- The demand for health care and social assistance is likely to increase in response to more frequent extreme weather events, possibly resulting in increased employment opportunities in the Region;
- Indoor shopping environments such as malls may become more popular destinations for those living within and outside of the Eastern Region, particularly during extreme heat events;
- The regional economic contribution of the construction sector may increase as demand for services increases as extreme events such as bushfire or flooding occur more frequently;
- Increased risk of bushfire may see more visitation to the Eastern Region to utilise shops, accommodation and services as residents from fire prone areas seek refuge;
- As average temperatures increase, there may be more potential to hold events during non-summer months (e.g. winter and spring);
- As rainfall declines, particularly in winter/spring, there may be more opportunity for holding events and festivals; and
- The utilisation of open space may increase in winter and spring as conditions become more suitable for outdoor activities.

4 Transitioning from the IVA to adaptation planning

The final stage of Resilient East is to prepare the Climate Change Adaptation Plan. The themes derived from the indicators as described in section 3 of this report (refer Table 6) will comprise the focus for the adaptation planning process.

The primary aim of the adaptation planning process will be to consider the themes or areas of focus and identify adaptation actions that reduce or address their vulnerability (or build on their resilience or take advantage of an opportunity that is presented by climate change).

Adaptation actions may result in:

- Reduced exposure; and/ or
- Reduced sensitivity; and/ or
- Improved adaptive capacity.

4.1 Proposed areas of focus

Resilient East is using adaptation pathways analysis to prepare the Climate Change Adaptation Plan. An important step in undertaking this approach is to frame the areas of focus that have been identified by the analysis of the IVA as 'key areas of decision making'.

Key areas of decision making comprise questions that the Adaptation Plan is looking to respond to and are made up of the following elements:

- The objective of what the Region is looking to achieve in relation to an aspect of feature that is valued. For example, *provide, protect and manage*;
- The valued feature or aspect that the Region is focussed on. For example, the health, safety and wellbeing of vulnerable members of the community; and
- The reason why the Region needs to take action, i.e. in response to a particular climate impact such as increased frequency and intensity of heat waves.

For Resilient East, 8 key areas of decision making are proposed (refer Table 7).

Table 7 Resilient East key areas of decision making

| Theme | Rationale | Proposed key area of decision making |
|--|---|---|
| <p>Vulnerable members of the community (ie those needing assistance with core activities eg frail aged or people with a disability)</p> | <p>Community connection and inclusion is valued by the Eastern Region, and age and socio-economic and health factors are indicators of capacity of the Region’s community. The IVA found that climate change will adversely impact the health safety and wellbeing of vulnerable members of the community. These impacts include direct health effects of extreme heat on older people and people who are living with a disability or need assistance with core services as well as the ability to support these vulnerable members of the community as bushfire risk increases.</p> | <p>How do we improve the health, safety and wellbeing of vulnerable members of the community as the frequency and intensity of heat waves and bushfires increase?</p> |
| <p>Open and green spaces</p> | <p>Open and green spaces in the Eastern Region are highly valued for the contribution they make to the Region’s character and amenity and creating environments that people want to spend time in. These open and green spaces also contribute to the health and wellbeing of the community through the opportunities they provide for recreation, relaxation and social connection and contribute to biodiversity in the Region. The IVA found that open and green spaces will be impacted by climate change due to warmer and drier conditions and climate extremes such as heatwave and bushfire. The effect will vary for open and green spaces across the Region depending on their access to irrigation and location in proximity to or within fire risk areas.</p> | <p>How do we provide, protect and enhance the amenity, biodiversity and recreation opportunities provided by open space as our climate becomes warmer and drier and there is an increased risk of damage from heat waves and bushfires?</p> |
| <p>Natural landscapes</p> | <p>The natural landscapes of the Eastern Region are valued for their intrinsic value and the contribution they make to the Region’s amenity and character. Natural landscapes include the remnant vegetation and foothills environments and the biodiversity scattered throughout the more urbanised areas such as along streets and in parks and reserves. Aboriginal heritage, including watercourses, pools, wetlands and areas of vegetation are also included as their condition is closely related to the condition of natural landscapes. The IVA found that climate change will impact the condition of natural landscapes due to warmer and drier conditions and climate extremes such as heatwave and bushfire.</p> | <p>How do we protect and enhance the condition of natural landscapes across the plains and hills face as our climate becomes warmer and drier and the risk of extremes such as heat wave and bushfire increases?</p> |

| Theme | Rationale | Proposed key area of decision making |
|---|--|---|
| Urban areas | The urban areas of the Eastern Region are valued for their contribution to amenity and quality of life of the people who live, work and visit the Eastern Region. 55% of the Region is residential areas and the remainder predominantly commercial and industrial land uses. The built form of these urban areas is mainly low density, with some medium density. Many areas in the Eastern Region are earmarked to transition to medium density. Ensuring that amenity and quality of life is maintained and enhanced in the face of climate change impacts will be critical. The IVA found that the Region’s urban areas will be impacted by climate change due to warmer and drier conditions and climate extremes such as heatwave and bushfire which will influence the Region’s attraction as a place to live, do business and visit. | How do we create better amenity and liveability in our urban areas as our climate becomes warmer and drier and the risk of extremes such as heat wave and bushfire increases? |
| Activity centres (eg main streets and CBD environment) | Activity centres throughout the Eastern Region are valued for their contribution to the quality of life of residents and visitors alike through the provision of goods and services, employment and investment opportunities and vibrant destinations for shopping, socialising and celebration. The IVA found that the Region’s activity centres will be impacted by climate change due to warmer and drier conditions and climate extremes such as heatwave which will influence the amenity and vibrancy of the Region’s activity centres, particularly main streets and the CBD environment. | How do we improve the amenity and vibrancy of our activity centres as our climate becomes warmer and drier and the risk of heat waves increase? |
| Stormwater management infrastructure | Stormwater management infrastructure is valued by the Eastern Region for its contribution to flood mitigation to protect the built and natural environment and public safety. It is also valued for its contribution to supporting the sustainable use of water resources through measures such as wetlands and water sensitive urban design which assist with maintaining other aspects valued across the Region through the irrigation of open space, streetscapes and public realm. The IVA found that stormwater management infrastructure will be impacted by climate change due to increasing rainfall intensity and will play an important role in enhancing amenity of the Region as annual rainfall declines and the risk of heatwaves rises. | How do we design, construct and maintain stormwater management infrastructure so that it provides flood protection, maximises reuse opportunities and enhances amenity as annual rainfall declines, rainfall intensity increases and the risk of heatwaves rises? |

| Theme | Rationale | Proposed key area of decision making |
|--|---|--|
| Community participation (services, places and spaces) | Community participation in events, celebrations and activities is valued by the Eastern Region for its contribution to community connection and inclusion, quality of life and vibrancy and the generation of commerce, investment and employment. The IVA found that participation in events, celebrations and activities will be impacted by climate change due to increasing rainfall intensity and climate extremes such as heatwave and bushfire. These changes will impact the ability of spaces and places such as parks and open spaces, community buildings, streets and plazas to hold events, celebrations and activities as well as people’s desire to participate. | How do we support and grow participation in events, celebrations and activities as rainfall intensity, frequency, intensity and duration of heat waves and bushfire risk increases? |
| Continuity of services | The continuity of essential services (e.g. electricity) is valued by the Eastern Region as it underpins the economy and the amenity and quality of life of the community. The IVA found that the continuity of services will be impacted by climate change due to disruptions to electricity services during climate extremes such as heatwave and bushfire. | How do we minimise disruption to business, events and infrastructure and residents reliant on electricity as we are exposed to more frequent and intense heatwave and greater fire risk? |

5 Next steps

The third and final stage of Resilient East will be to develop adaptation pathways for each of the key decision areas identified in section 4 of this report.

This process will involve working with stakeholders via a two staged process as follows:

- Workshop 1 - During the first of the adaptation planning workshops information will be collected to determine the range of options that are being considered for adaptation, including an assessment of the ability of current practices to cope with climate change. A qualitative assessment will be undertaken of the costs and benefits of different options as a way of establishing no-regret, low regret, win-win or flexible adaptation options. Information will also be gathered on the lifespan of potential adaptation options in the face of different climate change impacts. Stakeholders' experience of barriers to adaptation will be explored at this workshop, including discussion about relevant roles and responsibilities.
- Workshop 2 - During the second adaptation planning workshop, stakeholders will be presented with draft adaptation pathways maps illustrating potential sequencing of adaptation options for comment. Feedback from the workshop will be used to refine "preferred" or "emerging" pathways. Discussion at the workshop will also focus on the barriers to adaptation and identification of roles and responsibilities as they relate to specific adaptation options identified by stakeholders.

Once the pathway maps are completed the Climate Change Adaptation Plan will be prepared bringing together all relevant inputs from earlier project tasks and identifying key actions to be progressed in the Region.

6 References

Resilient East (2014) *Vision, Values and Key Decisions Report*, prepared by URPS as part of the Resilient East consultancy led by URPS, for the Eastern Region in association with the Government of South Australia and the Australian Government

Resilient East (2015) *Climate Projections Report*, prepared by URPS and Seed Consultancy Services as part of the Resilient East consultancy led by URPS, for the Eastern Region in association with the Government of South Australia and the Australian Government.

Appendix A

Organisations that have participated in Resilient East to date

Adelaide and Mt Lofty Ranges NRM
Adelaide City Council
Adelaide University
Australian Council of Private Education and Training Providers
Australian Red Cross
Bureau of Meteorology
Charles Campbell College
City of Burnside
City of Campbelltown
City of Norwood Payneham & St Peters
City of Prospect
City of Tea Tree Gully
City of Unley
Conservation Council of SA
Department for Health and Ageing
Department for State Development
Department of Planning Transport and Infrastructure
Eastside Business Enterprise Centre
EPA
Housing SA
Local Government Association
North East Development Agency Inc
Norwood Residents' Association
Office of Public Health, Department for Health and Ageing
Planning Institute of Australia
SA Police
SA Country Fire Service
SA Health
SA Water
SA Metropolitan Fire Service
SA Power Networks
Seed Consulting Services
SES
Shelter SA
Sustainable Communities SA
Town of Walkerville
Trees for Life
University of Adelaide
University of South Australia
URPS
Volunteering SA
Weed Management Society of SA

Appendix B

Indicators and values

| Valued Feature | Indicator assessed by the IVA | Resilient East Values | | | | | | | | |
|--|---|-----------------------|-------|---|---------------------------------|------------------------------|--------------------------|------------|--------------------------------------|--------------------------------|
| | | Open and green spaces | Water | Community engagement, education and participation | Community connection, inclusion | Health, wellbeing and safety | Habitat and biodiversity | Governance | Infrastructure and built environment | Economic activity and vibrancy |
| Medium and high density residential land use | Amenity and liveability of medium and high density residential areas | ✓ | | ✓ | | ✓ | | ✓ | ✓ | ✓ |
| Low density residential land use | Amenity and liveability of low density residential areas | ✓ | | ✓ | | ✓ | | ✓ | ✓ | |
| State and local heritage items (built) | Condition of State and local heritage items (built items) | | | | ✓ | | | ✓ | ✓ | |
| Aboriginal heritage (natural heritage e.g. watercourses, natural wetlands) | Condition of Aboriginal heritage (natural heritage e.g. watercourses, natural wetlands) | ✓ | | | ✓ | | ✓ | ✓ | | |
| Natural watercourses (biodiversity and amenity) | Condition of natural watercourses (biodiversity and amenity) | ✓ | ✓ | | | ✓ | ✓ | ✓ | ✓ | |
| Groundwater | Condition of groundwater (water levels and salinity) | | ✓ | | | | ✓ | ✓ | | |
| Stormwater management features (WSUD and wetlands) | Effective functioning of stormwater management features (WSUD, wetlands, basins, pumps) | ✓ | ✓ | | | | | ✓ | ✓ | |

| Valued Feature | Indicator assessed by the IVA | Resilient East Values | | | | | | | | |
|--|--|-----------------------|-------|---|---------------------------------|------------------------------|--------------------------|------------|--------------------------------------|--------------------------------|
| | | Open and green spaces | Water | Community engagement, education and participation | Community connection, inclusion | Health, wellbeing and safety | Habitat and biodiversity | Governance | Infrastructure and built environment | Economic activity and vibrancy |
| Irrigated open space (including sports grounds and parks) | Amenity, character and recreation opportunities provided by irrigated open space | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | | ✓ |
| Natural open space (not irrigated) | Amenity, character, habitat, biodiversity and recreation opportunities provided by natural open space | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | |
| Linear Parks (Torrens, Cobbler Creek, Dry Creek) | Amenity, character and recreation opportunities provided by Linear parks | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | |
| Park Lands | Amenity, character, recreation and event opportunities provided by Adelaide Park Lands | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | |
| All open space | Utilisation of open space areas | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | |
| Public realm (green - street trees, landscaped streetscapes) | Amenity, character and shelter/comfort provided by public realm (street trees and landscaped streetscapes) | ✓ | ✓ | | ✓ | ✓ | | ✓ | | |
| Public realm (built - street furniture, signage) | Effective functioning of public realm (built infrastructure) | ✓ | | | ✓ | | | ✓ | ✓ | |

| Valued Feature | Indicator assessed by the IVA | Resilient East Values | | | | | | | | |
|---|--|-----------------------|-------|---|---------------------------------|------------------------------|--------------------------|------------|--------------------------------------|--------------------------------|
| | | Open and green spaces | Water | Community engagement, education and participation | Community connection, inclusion | Health, wellbeing and safety | Habitat and biodiversity | Governance | Infrastructure and built environment | Economic activity and vibrancy |
| Native vegetation (in National Parks or Council reserves) | Condition and extent of remnant native vegetation | ✓ | ✓ | | | | ✓ | ✓ | | |
| Aged over 65 | Health, safety and wellbeing of vulnerable members of the community (those aged over 65) | | | ✓ | ✓ | ✓ | | ✓ | | |
| Needing assistance with core activities | Health, safety and wellbeing of vulnerable members of the community (those with a disability) | | | ✓ | ✓ | ✓ | | ✓ | | |
| CALD community members | Health, safety and wellbeing of vulnerable members of the community (CALD members of the community) | | | ✓ | ✓ | ✓ | | ✓ | | |
| Low income individuals and/or families | Health, safety and wellbeing of vulnerable members of the community (low income individuals and/or families) | | | ✓ | ✓ | ✓ | | ✓ | | |
| Community events, celebrations and activities (outdoor) | Community participation in outdoor community events, celebrations and activities | ✓ | | ✓ | ✓ | ✓ | | ✓ | | ✓ |
| Volunteering | Rates of volunteering in the community | | | | ✓ | ✓ | | ✓ | | |

| Valued Feature | Indicator assessed by the IVA | Resilient East Values | | | | | | | | |
|--|---|-----------------------|-------|---|---------------------------------|------------------------------|--------------------------|------------|--------------------------------------|--------------------------------|
| | | Open and green spaces | Water | Community engagement, education and participation | Community connection, inclusion | Health, wellbeing and safety | Habitat and biodiversity | Governance | Infrastructure and built environment | Economic activity and vibrancy |
| Demand for emergency services | Demand for emergency services | | | | | ✓ | | ✓ | ✓ | |
| Arts and cultural infrastructure | Effective functioning of arts and cultural facilities (art galleries, libraries, theatres, community centres) | | | ✓ | ✓ | | | ✓ | ✓ | ✓ |
| Walking and cycling paths | Effective functioning of walking and cycling paths | ✓ | | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ |
| Roads | Effective operation of road network | | | | | ✓ | | ✓ | ✓ | ✓ |
| Public transport (buses, rail, busway, tram) | Increased use of public transport services | | | | ✓ | | | ✓ | ✓ | ✓ |
| Potable water supply | Effective operation of potable water supply (e.g. pipes and pumps) and treatment plants | | ✓ | | | ✓ | | ✓ | ✓ | ✓ |
| Wastewater treatment (SA Water) | Effective operation of SA Water wastewater treatment network (e.g. pipes and pumps) | | ✓ | | | ✓ | | ✓ | ✓ | ✓ |
| Wastewater treatment (CWMS - Council) | Effective operation of CWMS wastewater treatment network (e.g. pipes and pumps) | | ✓ | | | ✓ | | ✓ | ✓ | ✓ |

| Valued Feature | Indicator assessed by the IVA | Resilient East Values | | | | | | | | |
|--|--|-----------------------|-------|--|---------------------------------|------------------------------|--------------------------|------------|--------------------------------------|--------------------------------|
| | | Open and green spaces | Water | Community engagement, education and recreation | Community connection, inclusion | Health, wellbeing and safety | Habitat and biodiversity | Governance | Infrastructure and built environment | Economic activity and vibrancy |
| Built assets- houses | Thermal performance of housing (comfort levels for tenants and reduce impacts for heat waves) | | | | | ✓ | | ✓ | ✓ | |
| Built assets | Effective operation of Government owned built assets (e.g. community, sporting, recreational, school facilities) | | | | ✓ | ✓ | | ✓ | ✓ | |
| Electricity transmission | Effective operation of electricity supply network | | | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ |
| Retail and commercial centres | Effective functioning, viability and vibrancy of retail and commercial centres | | | ✓ | ✓ | | | ✓ | | ✓ |
| Major events and celebrations | Wealth and vibrancy generated by major events | | | ✓ | ✓ | | | ✓ | | ✓ |
| GRP - top 3 contributors - Finance and Insurance | Regional economic contribution of the finance and insurance sector | | | | | | | ✓ | | ✓ |
| GRP - top 3 contributors - Professional, scientific and technical services | Regional economic contribution of the professional, scientific and technical services sector | | | | | | | ✓ | | ✓ |

| Valued Feature | Indicator assessed by the IVA | Resilient East Values | | | | | | | | |
|---|--|-----------------------|-------|---|---------------------------------|------------------------------|--------------------------|------------|--------------------------------------|--------------------------------|
| | | Open and green spaces | Water | Community engagement, education and culture | Community connection, inclusion | Health, wellbeing and safety | Habitat and biodiversity | Governance | Infrastructure and built environment | Economic activity and vibrancy |
| GRP - top 3 contributors - Construction | Regional economic contribution of the construction sector | | | | | | | ✓ | | ✓ |
| Live and work in the region - top 3 employers - Health care and social assistance | Employment in the health care and social assistance sector | | | | | | | ✓ | | ✓ |
| Live and work in the region - top 3 employers - Professional, scientific and technical services | Employment in the professional, scientific and technical services sector | | | | | | | ✓ | | ✓ |
| Live and work in the region - top 3 employers - Public administration and safety | Employment in the public administration and safety | | | | | | | ✓ | | ✓ |

Appendix C

Results of the IVA.

| Sector | Subgroup | Valued feature | Indicator /s | Exposure (Climate Variable) | Exposure Score | Sensitivity to Climate Variable | Sensitivity Score | Sensitivity Comment | Potential Impact Score | Adaptive Capacity Score | Adaptive Capacity Comment | Vulnerability Score |
|--|--------------------|---|--|---|----------------|---------------------------------|-------------------|--|------------------------|-------------------------|---|---------------------|
| Community well being and economic prosperity | Community services | Community events, celebrations and activities (outdoor) | Community participation in outdoor community events, celebrations and activities | Fire risk - increasing | 5 | High | 5 | Events may have to be rescheduled or cancelled if total fire bans or catastrophic fire danger, locations and facilities used may be damaged, access restrictions to attend events, smoke impacts on community participants, | 10 | 3 | Recent experience from Sampson Flat fire and TDU - could have had to cancel . Sporting events were relocated during SF flat, need to rebuild infrastructure, size of event and significance greater size would be likely to have contingency planning, some larger events would have to be cancelled as not suitable alternative venue, also potential impact on health and well being of community attendees, smaller local events difficult to move as not in local area for community, bigger events difficult to move, can postpone some , but difficult if have large production infrastructure During a fire, people may be less likely to attend due to health, access constraints, change of community focus | 17 |
| Community well being and economic prosperity | Community services | Community events, celebrations and activities (outdoor) | Community participation in outdoor community events, celebrations and activities | Heatwaves - increased frequency and intensity | 5 | Moderate to High | 4 | Events may have to be rescheduled or cancelled if coincide with heat waves, people will not participate in hot weather, heat felt across entire region People with children or elderly more sensitive to heat, younger populations less sensitive and likely to go to evening events, | 9 | 6 | Some events can use cooling tents, provide water, can move events later in day, can't stop a bushfire but can provide shade and cooling to make conditions more comfortable, shade areas like at Thorndon Park, TDU moved end to irrigated and shaded area makes better conditions Already had to deal with heat waves in recent times, included in event planning, site choice etc Private event operators may be less prepared, heat may be included in risk management but decision making on the day may not be as well prepared Summer events already usually planned for evenings | 13 |
| Community well being and economic prosperity | Community services | Community events, celebrations and activities (outdoor) | Community participation in outdoor community events, celebrations and activities | Rainfall intensity - increasing | 3 | High | 5 | Events may have to be rescheduled or cancelled if coincide with heavy rainfall, also flooding following event, Moon lantern festival cancelled last two years Unpredictable weather - used to be able to plan for dry summer but more summer storms | 8 | 4 | Equipment tents or infrastructure can be at risk of winds and rain, can hire more heavy duty caravans etc but at cost. Some smaller events can be postponed but larger or date based events (eg Anzac Day) can not, People are less likely to go out in wind and rain with umbrellas etc but not consider lightening risk Ovals etc may be unusable without cover (eg plastic) of have boggy grass Road closures and access restrictions may also prevent people from attending events | 14 |
| Community well being and economic prosperity | Community services | Community events, celebrations and activities (outdoor) | Community participation in outdoor community events, celebrations and activities | Temperature - increased summer and autumn | 4 | Low to Moderate | 2 | Possibly need to have less events in summer and early autumn when higher temperatures expected, generally warmer weather through autumn | 6 | 7 | Able to plan for events different times of year and different time of day. Seasonal events (Christmas etc) cant be moved but | 9 |
| Community well being and economic prosperity | Community services | Community events, celebrations and activities (outdoor) | Community participation in outdoor community events, celebrations and activities | Rainfall - declining spring | 5 | Low | 1 | Possible opportunity for more events as less rain in Spring and Autumn OPPORTUNITY | 6 | 7 | Potential to plan more events for April and May when may be better weather, might need change in community expectation of when events are occurring, might not plan for larger events in winter if didn't have alternate venue opportunity, smaller events more likely, predictability of weather , still going to rain in winter similar amount | 9 |

| Sector | Subgroup | Valued feature | Indicator /s | Exposure (Climate Variable) | Exposure Score | Sensitivity to Climate Variable | Sensitivity Score | Sensitivity Comment | Potential Impact Score | Adaptive Capacity Score | Adaptive Capacity Comment | Vulnerability Score |
|--|---------------------|---------------------------------------|---|---|----------------|---------------------------------|-------------------|--|------------------------|-------------------------|--|---------------------|
| Community well being and economic prosperity | Community services | Meeting demand for emergency services | Meeting demand for emergency services | Fire risk - increasing | 5 | High | 5 | Emergency services very likely to be required for life and property protection | 10 | 4 | Capability of CFS, MFS and arrangement with other states to bring in additional resource Volunteer situation ok at the moment, in some SES units can not take more volunteers, generally in country areas less volunteers (restructure in progress may impact resourcing), increase in demand for volunteer resource for emergency management may have impact when people cant take time off work, During emergency the availability of volunteers can be limited by other competing needs (care for family etc) Competing need for resources interstate so during fire event volunteers may not be available, and local volunteers might be called interstate as well Control centres, emergency centres identified based on individual conditions Infrastructure Community resilience important to protect own property, difficulty with aging population Community awareness and education Council bushfire management and preparation plans, fuel reduction on public land Following events, debriefs with all responsible agencies look at resourcing | 16 |
| Community well being and economic prosperity | Community services | Meeting demand for emergency services | Meeting demand for emergency services | Heatwaves - increased frequency and intensity | 5 | High | 5 | Emergency services (ambulance, hospitals) very likely to be required | 10 | 7 | During recent heatwaves, hospital presentations not as high during actual heat but following event related health issues become worse and more ambulance call outs Links to prevention through green areas, cooling houses etc Awareness materials, Red Cross telecross REDi , heat wave can activate additional calls, Dept of Health information, might need more volunteers for Red Cross etc, media role in awareness raising Demand for emergency services during events held during extreme heat = more demand for first aid | 13 |
| Community well being and economic prosperity | Community services | Meeting demand for emergency services | Meeting demand for emergency services | Rainfall intensity - increasing | 3 | High | 5 | Emergency services very likely to be required for life and property protection, flash flooding issues | 8 | 7 | Most Councils have stormwater management issues considered and flood mapping helps protect property, responding to flood issues need volunteers (SES and CFS) to sand bag Councils often have infrastructure in place at depots etc, have flood warning systems to help prepare for slow build up events, swift water events SES have teams to respond | 11 |
| Community well being and economic prosperity | Community services | Arts and cultural infrastructure | Effective functioning of arts and cultural facilities (art galleries, libraries, theatres, community centres) | Fire risk - increasing | 5 | High | 5 | Built assets highly sensitive to damage or destruction by bushfire, increase demand for facilities not in bushfire risk area from people as refuge location | 10 | 3 | Building code requires separation distances from vegetation, are Councils as well prepared for fire in "metro areas", might have increase demand during catastrophic fire days as place of refuge, might not be well prepared for this | 17 |
| Community well being and economic prosperity | Community services | Arts and cultural infrastructure | Effective functioning of arts and cultural facilities (art galleries, libraries, theatres, community centres) | Heatwaves - increased frequency and intensity | 5 | Moderate to High | 4 | Not out of action longer term but increase demand places increase stress on resourcing and operations to function effectively | 9 | 3 | Some older buildings don't have good air conditioning and if want to encourage people to come as a refuge, need to have better facilities | |
| Community well being and economic prosperity | Community services | Arts and cultural infrastructure | Effective functioning of arts and cultural facilities (art galleries, libraries, theatres, community centres) | Rainfall intensity - increasing | 3 | Moderate | 3 | Short term flooding may result in some damage to contents and inability to open facilities for use, have seen recent problems during rain from box gutters, older buildings particularly sensitive | 6 | 4 | Insufficient resourcing for fixing leaking older Council buildings, some stormwater management actions addressing surface flows, heritage listed buildings often used for community centres and so more expensive to repair and maintain, can section parts of building off (rarely close) | 12 |
| Community well being and economic prosperity | Economic prosperity | Retail and commercial centres | Effective functioning, viability and vibrancy of retail and commercial centres | Fire risk - increasing | 5 | Low to Moderate | 2 | Restrictions in access to retail areas, during high fire danger days retail in eastern Adelaide can see positive outcome for retail as visited by residents avoiding danger OPPORTUNITY | 7 | 5 | Emergency management planning in place. Higher community awareness and preparedness relating to fire risk. People understand potential impact of fire as opposed to flooding and extreme heat. | 12 |

| Sector | Subgroup | Valued feature | Indicator /s | Exposure (Climate Variable) | Exposure Score | Sensitivity to Climate Variable | Sensitivity Score | Sensitivity Comment | Potential Impact Score | Adaptive Capacity Score | Adaptive Capacity Comment | Vulnerability Score |
|--|---------------------|---|--|---|----------------|---------------------------------|-------------------|---|------------------------|-------------------------|--|---------------------|
| Community well being and economic prosperity | Economic prosperity | Retail and commercial centres | Effective functioning, viability and vibrancy of retail and commercial centres | Heatwaves - increased frequency and intensity | 5 | Moderate | 3 | People are less likely to spend time in small shops (i.e. in malls or streets without air-conditioning). More people may go to large regional shopping centres (e.g. Tea Tree Plaza). (Note assumes electricity supply not affected - electricity supply considered in separate indicator) Also people employed in retail can be sensitive to heat and may not turn up for work. People are less likely to go to retail areas on hot days. Changes to activity to be required activities and less optional activities Research by City of Melbourne. Research about higher levels of absenteeism from commercial sector based jobs. | 8 | 4 | Air-conditioning, landscaping, tree planting in car parks, but not much due to developers not wanting to sacrifice carparks for vegetation, provide landscaping. Veranda provides shading. Lack of insurance and business continuity planning by SMEs. Potential for food spoilage and public health impacts. Lower income people may not have access to own vehicles, may be more absent from work due to lack of respite overnight, ability to get to work etc. Manufacturing sector may need to shut down due to heat. Outdoor workers associated with deliveries network of suppliers may shut down. Adaptive capacity is significantly related to continuity of power supply. May present an opportunity for indoor mall environments. | 14 |
| Community well being and economic prosperity | Economic prosperity | Retail and commercial centres | Effective functioning, viability and vibrancy of retail and commercial centres | Rainfall intensity - increasing | 3 | Moderate | 3 | Short term flooding may result in some damage to contents and inability to open for trade, potential for public health issues at food premises, access to shops, underground carparks. Polarised choice for consumers who choose to go to covered environments versus open street environments | 6 | 3 | Covered mall environments have higher adaptive capacity. High street environments have little shelter and not as attractive to shoppers. Some centres are located in flood prone areas. Undergrounding of creeks below developed areas. TTP car parking gets flooded. Centre is fine but accessibility is impacted by flooding. Insurance and business continuity plans don't exist (22,000 SMEs), not on their radar, focussing on day to day. Storms that often accompany intense rainfall e.g. power outage. Big providers have back up power supply, but not SMEs shut down in power outage. Much of the region is strip shopping. Dependent on each Council's approach to stormwater management planning. AMLRNRM can require creek maintenance to help prevent flooding. Underground services can be affected by flooding (e.g. fibre optic cabling). Some data centres are located in basements of buildings or in flood prone areas e.g. Greenhill Road. Some locations have better stormwater infrastructure than others e.g. TTG and ACC. Employees may not be able to get to work if surrounding areas experience localised flooding which will impact economic prosperity. May present an opportunity for indoor mall environments. Age and condition of buildings-many are old, under poor condition and experience internal flooding from roofs etc. | 13 |
| Community well being and economic prosperity | Economic prosperity | Live and work in the region - top 3 employers - Health care and social assistance | Employment in the health care and social assistance sector | Fire risk - increasing | 5 | Moderate | 3 | Demand for health care and social assistance is likely to increase in response to more frequent extreme weather events, possibly resulting in increased employment (OPPORTUNITY) | 8 | 3 | OHS policies may restrict ability to provide services on high risk days. Risk is localised and may not impact employees directly or ability to work. Diversity of services that may be able to offer assistance. | 15 |
| Community well being and economic prosperity | Economic prosperity | Live and work in the region - top 3 employers - Health care and social assistance | Employment in the health care and social assistance sector | Heatwaves - increased frequency and intensity | 5 | Moderate to High | 4 | Demand for health care and social assistance is likely to increase in response to more frequent extreme weather events, possibly resulting in increased employment (OPPORTUNITY) | 9 | 3 | Public sector funded so may reduce adaptive capacity-demand may not be able to be met. Funding per capita is dropping over time. People may be more thinly spread and under greater stress as demand increases. OHS policies may restrict ability to service demand at peak times. Increased stress on service providers and staff. Employees may abandon jobs as it is too hard. Existing poor working conditions may be exacerbated by stress from heat waves and increased demand for services. Absenteeism of workers, health impacts on employees, ability to access workplace if reliant on public transport. Sector may grow as result of climate change-may not be variable specific. | 16 |

| Sector | Subgroup | Valued feature | Indicator /s | Exposure (Climate Variable) | Exposure Score | Sensitivity to Climate Variable | Sensitivity Score | Sensitivity Comment | Potential Impact Score | Adaptive Capacity Score | Adaptive Capacity Comment | Vulnerability Score |
|--|-------------------------------------|------------------------|---|---|----------------|---------------------------------|-------------------|---|------------------------|-------------------------|--|---------------------|
| Community well being and economic prosperity | Vulnerable members of the community | CALD community members | Health, safety and wellbeing of vulnerable members of the community (CALD members of the community) | Fire risk - increasing | 5 | High | 5 | Culturally and linguistically diverse communities likely to be more sensitive as not aware of issues, response options and may not understand warnings or advice. More so true for older people in this feature. International students face many of the same issues, but could be closer to the city or boarding with families and so have support. New migrants may have a different understanding compared with longer term residents in this sector. Tourists in the hills face zone may not be prepared at all. Understanding of fire risk can vary across CALD members, depending on cultural background. | 10 | 3 | There are some communications that are prepared in multiple languages. Some new migrants are not literate in their own language. Potentially better information for heat wave than for fire. There may be cultural issues (e.g. Requirement to wear certain clothing, although this differs between home and public spaces). Some multicultural communities have own resources and centres e.g. Italian community. Churches, mosques, temples and schools play an important role. Some CALD members have greater social inclusion than some existing community members. Less awareness about fire as a concept/threat. | 17 |
| Community well being and economic prosperity | Vulnerable members of the community | CALD community members | Health, safety and wellbeing of vulnerable members of the community (CALD members of the community) | Heatwaves - increased frequency and intensity | 5 | Moderate to High | 4 | Culturally and linguistically diverse communities likely to be more sensitive as not aware of issues, response options and may not understand warnings or advice. International students not always living in ideal conditions e.g.. Large number of people in single house. Concern about foreign works on visas and what information they are given regarding working conditions. | 9 | 4 | | 15 |
| Community well being and economic prosperity | Vulnerable members of the community | CALD community members | Health, safety and wellbeing of vulnerable members of the community (CALD members of the community) | Rainfall intensity - increasing | 3 | Moderate to High | 4 | Culturally and linguistically diverse communities likely to be more sensitive as not aware of issues, response options and may not understand warnings or advice | 7 | 6 | Need less knowledge to respond to rainfall. Flooding is more predictable. Greater ability to respond, with the exception of flash flooding | 11 |
| Community well being and economic prosperity | Vulnerable members of the community | Aged over 65 | Health, safety and wellbeing of vulnerable members of the community (those aged over 65) | Temperature - increase average | 4 | Moderate | 3 | May result in less need for heating in winter as temperatures increase. | 7 | 7 | Having to hand water did have an impact on people. It was a hazard in some instances. Gradual increase in temperature may make it easier to adapt. | 10 |
| Community well being and economic prosperity | Vulnerable members of the community | Aged over 65 | Health, safety and wellbeing of vulnerable members of the community (those aged over 65) | Heatwaves - increased frequency and intensity | 5 | High | 5 | Older people are highly sensitive because of mobility issues, pre-existing illness and poorer health in general. Economic factors as well - reduced ability to afford heating and cooling. Physiological issues regarding ability to adapt to heat stress. Social isolation - less likely to seek out cool places. Less opportunities to participate in outdoor activities. Personal mobility and access to transport two separate issues - access to transport can be a greater issue. Some transport can be unavailable during extreme heat. Potentially reduced ability for the volunteer resource to be available. | 10 | 4 | Telecross redi service provides some assistance. There are various people in this category, some with more economic resources and some with less. Green infrastructure can help reduce urban heat island effect. New houses will have higher star ratings, existing houses may only be 2-3 stars. Increasing numbers of older people in the future. There will be less people to provide services. | 16 |
| Community well being and economic prosperity | Vulnerable members of the community | Aged over 65 | Health, safety and wellbeing of vulnerable members of the community (those aged over 65) | Rainfall intensity - increasing | 3 | Moderate to High | 4 | Older people are highly sensitive because of mobility issues, pre-existing illness and poorer health in general. Less likely to be prepared for extreme events and respond at the time. Greater reliance on SES. May have less access to information about risks/extreme events. | 7 | 4 | Significant notice about floods. No better prepared for floods than for bushfires. Localised flooding may be a greater issue. If you are not prepared, there are many concerns e.g. clean up, electricity, damage to goods | 13 |

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| Community well being and economic prosperity | Vulnerable members of the community | Aged over 65 | Health, safety and wellbeing of vulnerable members of the community (those aged over 65) | Fire risk - increasing | 5 | High | 5 | Older people are highly sensitive because of mobility issues, pre-existing illness and poorer health in general. Greater isolation can reduce access to people who can assist. Communication methods can be reduced for older people e.g. Less likely to use the computer. If people cannot access transport they may not be able to move to emergency evacuation areas. May be disproportionately affected by smoke. Less likely to have gutters cleaned or fire breaks maintained. | 10 | 2 | Transport and mobility issues prevent ability to access emergency evacuation centres. Very low uptake of developing fire action plans. People believe there is lower likelihood of fire so are less prepared. More reluctant to leave your home. | 18 |
| Community well being and economic prosperity | Vulnerable members of the community | Needing assistance with core activities | Health, safety and wellbeing of vulnerable members of the community (people with disability) | Fire risk - increasing | 5 | High | 5 | Support services for core activities may not be available during extreme events for extended periods (>24 hours). | 10 | 1 | Very low. Mobility is a major issue. Ability to know that an extreme event is coming. Cognitive reasoning issues for people with an intellectual disability. Hearing disabilities can have issues communicating that they are in danger. Carers come and visit daily for people with some disabilities e.g. people in disability housing. Full time carers will live with the person with a disability. AC is lowest for fire because carers and/or volunteers are attending to their own needs. | 19 |
| Community well being and economic prosperity | Vulnerable members of the community | Needing assistance with core activities | Health, safety and wellbeing of vulnerable members of the community (people with disability) | Heatwaves - increased frequency and intensity | 5 | High | 5 | Support services for core activities may not be available during extreme events for extended periods (>24 hours). | 10 | 3 | Community is better prepared because greater awareness about the risk of heatwaves. Disability housing all have cooling. People with dementia may forget to drink during heat waves. | 17 |
| Community well being and economic prosperity | Vulnerable members of the community | Needing assistance with core activities | Health, safety and wellbeing of vulnerable members of the community (people with disability) | Rainfall intensity - increasing | 3 | High | 5 | Support services for core activities may not be available during extreme events for extended periods (>24 hours). Intense rainfall events will reduce access to core services but for shorter periods of time (< 24 hours). Higher sensitivity than other vulnerable groups as this indicator relates to those who may be physically unable to assist themselves. | 8 | 4 | | 14 |
| Community well being and economic prosperity | Community services | Volunteering | Rates of volunteering in the community | Heatwaves - increased frequency and intensity | 5 | Low | 1 | Great variation across sphere of volunteering activities, some one off events might be impacted by heat waves, project specific volunteers for outdoor events and activities might be impacted, other volunteering not likely to be affected, could have increase in number of people to volunteer in "heat refuge" locations eg libraries and community centres, demand for volunteers likely to increase, refer to other indicators and values related to vulnerable communities (and support for them) | 6 | 9 | Not considered that people consider the climate when deciding whether to volunteer or not over all, individual events or one off volunteering may be impacted | 7 |
| Community well being and economic prosperity | Community services | Volunteering | Rates of volunteering in the community | Rainfall intensity - increasing | 3 | Low | 1 | Support may be reduced or not available as family, friends and neighbours work to address their own inundation issues. People may choose to relocate to areas less likely to be inundated, thereby reducing their capacity to be close and assist during times of need. | 4 | 9 | Not considered that people consider the climate when deciding whether to volunteer or not over all, individual events or one off volunteering may be impacted | 5 |
| Community well being and economic prosperity | Economic prosperity | GRP - top 3 contributors - Construction | Regional economic contribution of the construction sector | Fire risk - increasing | 5 | Low to Moderate | 2 | Could be greater demand for construction if fire damage requires repair or rebuild (OPPORTUNITY) | 7 | 4 | Start earlier, need lighting if working in dark which has cost implications, noise restrictions so may not be able to operate earlier/later. Productivity may be impacted by heat if outdoors. | 13 |

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| Community well being and economic prosperity | Economic prosperity | GRP - top 3 contributors - Construction | Regional economic contribution of the construction sector | Heatwaves - increased frequency and intensity | 5 | Moderate | 3 | Impacts on workers in unairconditioned buildings and facilities, outdoor etc. are sensitive to high heat, construction sector may be more sensitive as more outdoor work | 8 | 4 | Start earlier, need lighting if working in dark which has cost implications, noise restrictions so may not be able to operate earlier/later. Productivity may be impacted by heat if outdoors. | 14 |
| Community well being and economic prosperity | Economic prosperity | Major events and celebrations | Wealth and vibrancy generated by major events | Fire risk - increasing | 5 | High | 5 | Major events would have to be cancelled or rescheduled which could add costs and reduce potential for future bookings May not have to occur at certain time of year. Access may be impacted as people can not access or stay at home. Major events are attended by people from out of region, interstate and overseas visitors. | 10 | 4 | Little notice re extreme events so not much time to reschedule. Patrons come from other areas not directly affected by fire which contributes to adaptive capacity. Less flexibility than smaller events. | 16 |
| Community well being and economic prosperity | Economic prosperity | Major events and celebrations | Wealth and vibrancy generated by major events | Heatwaves - increased frequency and intensity | 5 | Moderate to High | 4 | Events may have to be rescheduled or cancelled if coincide with heat waves, less people likely to attend if held during hot weather, Fringe attendance?? | 9 | 5 | Adaptive capacity can be location specific. E.g. hard surfaces e.g. Gouger Street Chinese New Year versus vegetated areas like park lands, parks have different amenity and comfort. Some events are date and location specific. Cooling/misting stations, provide water, ambulance staff. AFL have shortened pre-season. Restrictive due to international and other calendars. Changes in temperature may mean opportunity for more events in Winter, spring. | 14 |
| Community well being and economic prosperity | Economic prosperity | Major events and celebrations | Wealth and vibrancy generated by major events | Rainfall intensity - increasing | 3 | High | 5 | Events may have to be rescheduled or cancelled if coincide with extreme rainfall or storm event. Often have multiple events happening together. Economic loss may occur. | 8 | 3 | No ability to take major events indoors. Day events will struggle, but events of longer duration design measures can address e.g. drainage/flood protection measures for Garden of Unearthly Delights. Some events have indoor areas e.g. Royal show, also longer duration so attend on an alternative day. | 15 |
| Environment, water and public realm | Parks and reserves | Irrigated open space (including sports grounds and parks) | Amenity, character and recreation opportunities provided by irrigated open space | Fire risk - increasing | 5 | Moderate | 3 | Fire would destroy amenity and character both during and after event, may also damage or destroy irrigation equipment Irrigated open space often maintained with lower grass levels, often less understorey and only canopy trees, smaller areas often more suburban location, many irrigated ovals are also fire refuge / evacuation locations, some indirect smoke impacts also likely, most likely to occur in TTG and Campbelltown | 8 | 5 | Buffer zones in park for asset protection following strategic bushfire plan, starting to change choices for revegetation / planting with lower volatility, greater opportunity for planting as irrigation | 13 |
| Environment, water and public realm | Parks and reserves | Irrigated open space (including sports grounds and parks) | Amenity, character and recreation opportunities provided by irrigated open space | Heatwaves - increased frequency and intensity | 5 | Moderate to High | 4 | Amenity may be reduced as extreme heat affects plant health and vigour, European trees shut down, limb drop in large Eucalypts | 9 | 3 | Could increase irrigation but increasing cost limitation, during drought or water restrictions irrigation may be rationalised already, any water quality issues where recycled water used? Character of reserves might change - community perceptions of what open space should look like. Mulching areas under trees rather than grass to allow more water for trees. Many of the required actions are known but not adequately and consistently applied due to lack of support and funding | 16 |
| Environment, water and public realm | Parks and reserves | Irrigated open space (including sports grounds and parks) | Amenity, character and recreation opportunities provided by irrigated open space | Rainfall - declining annual average | 2 | Moderate | 3 | Irrigated areas likely to be less sensitive than non-irrigated areas - irrigation is adaptive capacity but here is also the feature | 5 | 3 | Any issues with increasing use of irrigation water where slightly more saline water? Availability of MAR water as rainfall and runoff reduces? Variability between Councils where GAP water available, more funding for some Councils than others, score applies to Councils with no alternate water source | 12 |
| Environment, water and public realm | Parks and reserves | Irrigated open space (including sports grounds and parks) | Amenity, character and recreation opportunities provided by irrigated open space | Rainfall intensity - increasing | 3 | Moderate to High | 4 | Amenity sensitive to flood damage and water erosion | 7 | 6 | Irrigated open space are often planned within reserves to provide flood protection, competing priorities for amenity and character, more events may require more resources for remediation, role of stormwater management plans in catchment management | 11 |

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| Environment, water and public realm | Parks and reserves | Linear Parks (Torrens, Cobbler Creek, Dry Creek) | Amenity, character and recreation opportunities provided by Linear parks | Fire risk - increasing | 5 | Moderate | 3 | Fire would destroy amenity and character both during and after event, more over grown pockets with higher fuel loads, steeper slopes, less fuel breaks (roads), difficult to access some parts, fire less likely to get out of control and burn large area due to linear nature and access | 8 | 2 | Vegetation management and weed control coordinated across land owners (Council and others) Strategic bushfire management plan | 16 |
| Environment, water and public realm | Parks and reserves | Linear Parks (Torrens, Cobbler Creek, Dry Creek) | Amenity, character and recreation opportunities provided by Linear parks | Heatwaves - increased frequency and intensity | 5 | Moderate | 3 | Amenity may be reduced as extreme heat affects plant health and vigour | 8 | 2 | Revegetation species selection | 16 |
| Environment, water and public realm | Parks and reserves | Linear Parks (Torrens, Cobbler Creek, Dry Creek) | Amenity, character and recreation opportunities provided by Linear parks | Rainfall - declining annual average | 2 | Moderate to High | 4 | Vegetation health sensitive to reduced rainfall, reduced flows along watercourses, less flushing flows, build up of debris, stagnant pools | 6 | 2 | River Torrens Linear Park Management Plan does identify issues but difficult to implement, currently not well resourced, complexity of multiple partners, consistency of management - governance issue | 14 |
| Environment, water and public realm | Parks and reserves | Linear Parks (Torrens, Cobbler Creek, Dry Creek) | Amenity, character and recreation opportunities provided by Linear parks | Rainfall intensity - increasing | 3 | High | 5 | Amenity highly sensitive to flood damage and water erosion, damage to paths or recreational assets, some private assets contributing and prone to flood damage (runoff) | 8 | 2 | May need to move paths, some paths designed to provide flood mitigation, land ownership limits ability to deal with flooding, increasing buffers, cant establish vegetation on steep banks, conflict where reserves designed to manage floods but recreational capacity reduced either short term when high flood waters and longer term following event. Planning for increase capacity for O-bahn parking and infrastructure, pressure of competing and multiple functions and features | 16 |
| Environment, water and public realm | Public realm | Public realm (green - street trees, landscaped streetscapes) | Amenity, character and shelter/comfort provided by public realm (street trees and landscaped streetscapes) | Fire risk - increasing | 5 | High | 5 | Amenity and ability to provide shelter highly sensitive to damage or destruction by bushfire | 10 | 7 | Fuel reduction practices. Compliance on private land to make sure residents reduce fuel. Fuel reduction on public lands. CFS work in relation to asset protection. Public education programs regarding reporting suspicious behaviour, awareness regarding fuel reduction, preparedness. Bushfire hazard mapping. Have to protect given proximity to residential development. Not much person made infrastructure so trees will naturally regenerate. risk is restricted to hills face areas in TTG, Campbelltown and Burnside. Tree risk assessment/audits undertaken. Tree replacement program. | 13 |
| Environment, water and public realm | Public realm | Public realm (green - street trees, landscaped streetscapes) | Amenity, character and shelter/comfort provided by public realm (street trees and landscaped streetscapes) | Heatwaves - increased frequency and intensity | 5 | Moderate to High | 4 | Amenity and ability to provide shelter may be reduced as extreme heat affects plant health and vigour | 9 | 3 | ACC street trees are not irrigated and have seen impacts during heatwaves e.g. drop leaves. Some councils irrigate via water trucks. Use of water barriers where known trees are struggling-reactive measure. Condition of urban street trees is more highly stressed, planted in constrained environments, pruning for electricity lines etc.-already up against it. Tree risk assessment/audits undertaken. Tree replacement program, however, if replacing mature trees with younger trees may have greater difficulty establishing. No overall strategic approach to planting urban forests. Requires significant resourcing. | 16 |

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| Environment, water and public realm | Public realm | Public realm (green - street trees, landscaped streetscapes) | Amenity, character and shelter/comfort provided by public realm (street trees and landscaped streetscapes) | Rainfall - declining annual average | 2 | Moderate to High | 4 | Street trees in particular sensitive to reduced rainfall and lower soil moisture. Recent droughts seen reductions in plant health and tree death | 6 | 5 | ACC street trees are not irrigated and have seen impacts during heatwaves e.g. drop leaves. Some councils irrigate via water trucks. Use of water barriers where known trees are struggling-reactive measure. Condition of urban street trees is more highly stressed, planted in constrained environments, pruning for electricity lines etc.-already up against it. Spring rainfall very important leading into summer as when get most rainfall which bolsters tree resilience. Tree risk assessment/audits undertaken. Tree replacement program. More suitable species selection and how plant the trees e.g. integration with WSUD. Residents remove street trees as don't want them reduces adaptive capacity. | 11 |
| Environment, water and public realm | Public realm | Public realm (green - street trees, landscaped streetscapes) | Amenity, character and shelter/comfort provided by public realm (street trees and landscaped streetscapes) | Rainfall - declining spring | 5 | High | 5 | Street trees in particular sensitive to reduced rainfall and lower soil moisture. Recent droughts seen reductions in plant health and tree death | 10 | 5 | ACC street trees are not irrigated and have seen impacts during heatwaves e.g. drop leaves. Some councils irrigate via water trucks. Use of water barriers where known trees are struggling-reactive measure. Condition of urban street trees is more highly stressed, planted in constrained environments, pruning for electricity lines etc.-already up against it. Spring rainfall very important leading into summer as when get most rainfall which bolsters tree resilience. Tree risk assessment/audits undertaken. Tree replacement program. More suitable species selection and how plant the trees e.g. integration with WSUD. Residents remove street trees as don't want them reduces adaptive capacity. | 15 |
| Environment, water and public realm | Public realm | Public realm (green - street trees, landscaped streetscapes) | Amenity, character and shelter/comfort provided by public realm (street trees and landscaped streetscapes) | Rainfall intensity - increasing | 3 | Moderate | 3 | Streetscapes sensitive to flood damage as adjacent gutters provide stormwater drainage in many areas | 6 | 5 | Some WSUD features/stormwater management features assist currently. Stormwater management features are currently under pressure. Stormwater management plans under development but not implemented. BHKC stormwater management plan still underway and not fully funded. Stormwater management plans are integrated to enhance biodiversity/environmental outcomes. Limited options when damaged e.g. narrow pathways along Magill Road, no room to put in stormwater management measures e.g. swales, garden beds etc. | 11 |
| Environment, water and public realm | Parks and reserves | Natural open space (not irrigated) | Amenity, character, habitat, biodiversity and recreation opportunities provided by natural open space (eg Council reserves, DEWNR parks) | Fire risk - increasing | 5 | High | 5 | Fire would destroy amenity and character both during and after event, may take some time to recover, DEWNR parks closed on total fire bans | 10 | 3 | Large cost to make safe after fire event, already behind in prevention through weed control etc, preparedness, management plans that cover biodiversity and fire, requires prioritisation of issues to consider other factors eg erosion, could be better resourced but does need staged approach, over abundant native species become more dominant, DEWNR parks closed on total fire bans but Council owned reserves not similarly managed, need to manage desired increased use with increase number of high fire danger days, likely to also be increased pressure from neighbours to undertake fuel reduction / fire breaks, might be increased demand for more fuel reduction burns | 17 |

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| Environment, water and public realm | Parks and reserves | Natural open space (not irrigated) | Amenity, character, habitat, biodiversity and recreation opportunities provided by natural open space (eg Council reserves, DEWNR parks) | Heatwaves - increased frequency and intensity | 5 | Moderate | 3 | Amenity may be reduced as extreme heat affects plant health and vigour, fauna unable to escape heat, potential for recreation opp reduced | 8 | 4 | Some management plans have more focus on asset protection and less about biodiversity management, likely to be changes in species composition, changed climate might need increased investment to find appropriate species that will survive, recreation opportunities may change as character changes, cooler gullies (Waterfall Gully, Morialta) may provide opportunity for recreation in hotter weather, bush has scattered shade not dense shade, great to have a range of natural open spaces with different environments | 14 |
| Environment, water and public realm | Parks and reserves | Natural open space (not irrigated) | Amenity, character, habitat, biodiversity and recreation opportunities provided by natural open space (eg Council reserves, DEWNR parks) | Rainfall - declining spring | 5 | Moderate to High | 4 | Vegetation health sensitive to reduced rainfall during Spring as soil moisture stores will be lower in advance of hot summer | 9 | 4 | Difficult for inherent adaptive capacity to enable natural adaptation to occur, seed sources for regeneration isolated, requires intervention, influence of adjoining private land, Council policy re native vegetation management on their own land but difficult to influence private land | 15 |
| Environment, water and public realm | Parks and reserves | Natural open space (not irrigated) | Amenity, character, habitat, biodiversity and recreation opportunities provided by natural open space (eg Council reserves, DEWNR parks) | Rainfall intensity - increasing | 3 | Moderate | 3 | Amenity sensitive to flood damage and water erosion | 6 | 4 | Need for knowledge of what species might be required to maintain as natural open space (not landscaped), resourcing may not be sufficient to address , competing priorities for reserves within Council by community, eg attachment to weed species | 12 |
| Environment, water and public realm | Parks and reserves | Parklands | Amenity, character, recreation and event opportunities provided by Adelaide Park Lands | Heatwaves - increased frequency and intensity | 5 | Moderate to High | 4 | Amenity may be reduced as extreme heat affects plant health and vigour, overall use for recreation reduced during heatwaves, take longer to recover | 9 | 7 | Currently succession plantings focus on drought tolerant trees, particularly natives, Park Lands Management Strategy does consider climate change, balance between shadier areas provided by deciduous trees, more irrigation and native species, mulching, GAP water available - not suitable for natives (high nutrient levels), watering during establishment by water trucks, high profile of Park Lands means resources are allocated to management and maintenance | 12 |
| Environment, water and public realm | Parks and reserves | Parklands | Amenity, character, recreation and event opportunities provided by Adelaide Park Lands | Rainfall - declining annual average | 2 | Moderate | 3 | Irrigated areas likely to be less sensitive than non-irrigated areas | 5 | 7 | Currently succession plantings focus on drought tolerant trees, particularly natives, Park Lands Management Strategy does consider climate change, balance between shadier areas provided by deciduous trees, more irrigation and native species, mulching, GAP water available - not suitable for natives (high nutrient levels), watering during establishment by water trucks | 8 |
| Environment, water and public realm | Biodiversity and water resources | Native vegetation (other) | Condition and extent of native vegetation | Fire risk - increasing | 5 | High | 5 | Native vegetation very sensitive to damage and destruction from bushfires, particularly at increased frequencies predicted. Scoring is being applied for the most vulnerable components of native vegetation. | 10 | 3 | There was adaptive capacity with an undeveloped landscape, but this is now different because of changed distribution and patch size of native vegetation. There may be lower AC because of the types of change in intensity and frequency. Prescribed burns do occur but they are more about asset protection but not a "biodiversity" burn. There may be some differences based on tenure but this is not enough to result in substantially different AC scores | 17 |
| Environment, water and public realm | Biodiversity and water resources | Native vegetation (other) | Condition and extent of native vegetation | Heatwaves - increased frequency and intensity | 5 | Moderate to High | 4 | Woodland areas. Extreme heat leads to greater stress on trees. Can cause mortality during an event. Extreme heat is coupled as an affect with declining rainfall. | 9 | 1 | Limited to no adaptive capacity. Repeated extreme heat events can occur more regularly than fire events. | 18 |
| Environment, water and public realm | Biodiversity and water resources | Native vegetation (other) | Condition and extent of native vegetation | Rainfall - declining winter | 1 | Moderate to High | 4 | Natural regeneration and soil moisture levels sensitive | 5 | 2 | Limited AC in response to reduced rainfall. There are small isolated pockets of remnant vegetation. There is low genetic diversity in existing stands. | 13 |
| Environment, water and public realm | Biodiversity and water resources | Native vegetation (other) | Condition and extent of native vegetation | Rainfall - declining spring | 5 | Moderate to High | 4 | Natural regeneration and soil moisture levels sensitive | 9 | 2 | Limited AC in response to reduced rainfall. | 17 |

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| Environment, water and public realm | Biodiversity and water resources | Native vegetation (other) | Condition and extent of native vegetation | Rainfall intensity - increasing | 3 | Low to Moderate | 2 | Riparian vegetation only moderately sensitive to flooding and erosion. Some systems in the region are more sensitive to intense rainfall and flooding, which leads to scouring and vegetation loss. | 5 | 4 | AC will depend on the system but assistance is often required to re-establish vegetation. Water sensitive urban design solutions are already being implemented. | 11 |
| Environment, water and public realm | Biodiversity and water resources | Native vegetation (other) | Condition and extent of native vegetation | Temperature - increased summer and autumn | 4 | Moderate to High | 4 | Changes in seasonal patterns may impact flowering times, seed production and ability for regeneration | 8 | 1 | Limited AC in existing systems to respond | 17 |
| Environment, water and public realm | Biodiversity and water resources | Native vegetation (other) | Condition and extent of native vegetation | Temperature - increased winter and spring | 5 | Moderate to High | 4 | Changes in seasonal patterns may impact flowering times, seed production and ability for regeneration, winter and spring more sensitive as when many species flowering | 9 | 1 | Limited AC in existing systems to respond | 18 |
| Planning, assets and infrastructure | Planning and heritage | Aboriginal heritage (natural heritage e.g. watercourses, natural wetlands) | Condition of Aboriginal heritage (natural heritage e.g. watercourses, natural wetlands) | Fire risk - increasing | 5 | High | 5 | Condition sensitive to direct damage or destruction from fire | 10 | 3 | Some fire management plans in place in DEWNR reserves. Council fuel reduction programs. Sites are not well documented and/or in public realm and not subject to specific management/protection regimes. | 17 |
| Planning, assets and infrastructure | Planning and heritage | Aboriginal heritage (natural heritage e.g. watercourses, natural wetlands) | Condition of Aboriginal heritage (natural heritage e.g. watercourses, natural wetlands) | Heatwaves - increased frequency and intensity | 5 | Low to Moderate | 2 | Hydrological change has greater impact on condition than temperature, some impacts on vegetation condition may be seen as heatwave frequency and intensity increase | 7 | 5 | Native vegetation is not irrigated. Sites are not well documented and/or in public realm and not subject to specific management/protection regimes. | 12 |
| Planning, assets and infrastructure | Planning and heritage | Aboriginal heritage (natural heritage e.g. watercourses, natural wetlands) | Condition of Aboriginal heritage (natural heritage e.g. watercourses, natural wetlands) | Rainfall - declining annual average | 2 | Moderate to High | 4 | All watercourses likely to have lower flows, particularly spring-fed streams which may be associated with natural wetlands and soaks | 6 | 3 | Sites are not well documented and/or in public realm and not subject to specific management/protection regimes. River Torrens flow releases contribute to AC but not clear if will continue. | 13 |
| Planning, assets and infrastructure | Planning and heritage | Aboriginal heritage (natural heritage e.g. watercourses, natural wetlands) | Condition of Aboriginal heritage (natural heritage e.g. watercourses, natural wetlands) | Rainfall intensity - increasing | 3 | Moderate to High | 4 | Condition sensitive to flood damage and water erosion | 7 | 4 | Stormwater management plans aim to reduce peak flows to minimise erosion risk along watercourses. Sites are not well documented and/or in public realm and not subject to specific management/protection regimes. | 13 |
| Environment, water and public realm | Biodiversity and water resources | Groundwater | Condition of groundwater (water levels and salinity) | Fire risk - increasing | 5 | Low to Moderate | 2 | Groundwater levels may be impacted if fires occur in recharge areas and runoff rates increase due to reduced native vegetation. Recharge may also be reduced if regrowth increases use of water from the soil column. | 7 | 5 | Moderate score is given but we have low confidence in the information used to score this indicator. | 12 |
| Environment, water and public realm | Biodiversity and water resources | Groundwater | Condition of groundwater (water levels and salinity) | Rainfall - declining winter | 1 | Moderate to High | 4 | Reduced winter rainfall likely to reduce recharge with impacts on gw levels and salinity. By 2050 reductions in rainfall may not have translated into reduce groundwater availability, but it is expected to occur over a longer period of time. | 5 | 5 | Area where groundwater is being recharged is outside of the region. | 10 |
| Environment, water and public realm | Biodiversity and water resources | Groundwater | Condition of groundwater (water levels and salinity) | Rainfall - declining spring | 5 | Moderate to High | 4 | Reduced winter rainfall likely to reduce recharge with impacts on gw levels and salinity, increased demand and extraction also likely. By 2050 reductions in rainfall may not have translated into reduce groundwater availability, but it is expected to occur over a longer period of time. | 9 | 5 | | 14 |
| Environment, water and public realm | Biodiversity and water resources | Groundwater | Condition of groundwater (water levels and salinity) | Temperature - increase average | 4 | Moderate to High | 4 | Increase in demand for groundwater as hotter temperatures require additional irrigation. Current SA Water study reviewing the code for open space irrigation, led by City of Marion (Glen Ricketts). Irrigation might increase but there is a cap on extraction for each zone in the Central Adelaide WAP. | 8 | 5 | There is a WAP policy but only allows for climate change impacts by reviewing extraction limits in the future. Will there be the political will in the future to reduce caps if required. Current system may lead to slow policy responses. | 13 |

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| Environment, water and public realm | Biodiversity and water resources | Natural watercourses (biodiversity and amenity) | Condition of natural watercourses (biodiversity and amenity) | Fire risk - increasing | 5 | Moderate to High | 4 | Riparian and aquatic vegetation likely to be damaged in fire, water quality decreased following fire as runoff contaminated, amenity reduced. Species are more sensitive to fire risk but exposure is less. This is accounted for in sensitivity score of 4 | 9 | 3 | Our ability to manage at the scale is limited | 16 |
| Environment, water and public realm | Biodiversity and water resources | Natural watercourses (biodiversity and amenity) | Condition of natural watercourses (biodiversity and amenity) | Heatwaves - increased frequency and intensity | 5 | Moderate to High | 4 | Hydrological change has greater impact on condition than temperature, some impacts on vegetation condition may be seen | 9 | 1 | Limited to no adaptive capacity | 18 |
| Environment, water and public realm | Biodiversity and water resources | Natural watercourses (biodiversity and amenity) | Condition of natural watercourses (biodiversity and amenity) | Rainfall - declining winter | 2 | Moderate to High | 4 | All watercourses likely to have lower flows, particularly spring-fed streams | 6 | 4 | There is some capacity through the provision of environmental flows. Consideration is also being given to low flow options. | 12 |
| Environment, water and public realm | Biodiversity and water resources | Natural watercourses (biodiversity and amenity) | Condition of natural watercourses (biodiversity and amenity) | Rainfall intensity - increasing | 3 | Moderate to High | 4 | Condition sensitive to flood damage and water erosion | 7 | 4 | Some protection works already exist. Will depend on the individual system. | 13 |
| Environment, water and public realm | Biodiversity and water resources | Natural watercourses (biodiversity and amenity) | Condition of natural watercourses (biodiversity and amenity) | Temperature - increase average | 4 | Moderate | 3 | Hydrological change has greater impact on condition than temperature | 7 | 1 | Limited to no adaptive capacity | 16 |
| Environment, water and public realm | Public realm | Public realm (built - street furniture, signage) | Effective functioning and utilisation of public realm (built infrastructure) | Fire risk - increasing | 5 | High | 5 | Built assets highly sensitive to damage or destruction by bushfire. Note that regionally much less infrastructure in hills face | 10 | 3 | Not sure how much public realm is in bushfire prone areas | 17 |
| Environment, water and public realm | Public realm | Public realm (built - street furniture, signage) | Effective functioning and utilisation of public realm (built infrastructure) | Heatwaves - increased frequency and intensity | 5 | Moderate to High | 4 | Potential for heat damage to some built assets, in particular those constructed from plastic or metal. People much less likely to use if hot | 9 | 4 | People less likely to use public realm due to heat. Health impacts if less active. Consideration of UV exposure in selection of materials. Where there is existing street scaping/street trees or shade structures higher adaptive capacity. People use 'harsher' environments less and only use if necessary. Shade structures can be impacted by wind. Services restrict ability to provide shading via street trees in city. In other Council areas may not be as restricted. Some Councils have mapped fountains. Reduced water may mean not be able to operate. | 15 |
| Planning, assets and infrastructure | Water assets | Wastewater treatment (CWMS - Council) | Effective operation of CWMS wastewater treatment network (e.g. pipes and pumps) | Fire risk - increasing | 5 | Low to Moderate | 2 | Treatment Plant would be only above ground asset highly sensitive to damage or destruction by bushfire, is in semi rural setting, pump stations are above ground and power outages could impact performance, power outages could impact pump station operation | 7 | 7 | Treatment Plan is source of water for irrigation (1ML per day) so flow on impacts for irrigated open Fire is consider in operating / management systems for plant | 10 |
| Planning, assets and infrastructure | Water assets | Wastewater treatment (CWMS - Council) | Effective operation of CWMS wastewater treatment network (e.g. pipes and pumps) | Rainfall - declining annual average | 2 | Low | 1 | Lower rainfall actually positive as less stormwater ingress impacting treatment operation | 3 | 8 | System operates better so no need for AC | 5 |
| Planning, assets and infrastructure | Water assets | Wastewater treatment (CWMS - Council) | Effective operation of CWMS wastewater treatment network (e.g. pipes and pumps) | Rainfall intensity - increasing | 3 | Moderate to High | 4 | Flooding results in sewer overflow, potential contamination, overload of stormwater transfer, existing ww network been prone to flood inundation and high downstream runoff | 7 | 6 | Testing and monitoring of network, education of property owners, TTG has about 10% of properties - plan to replace septic to sewer but more reactive than wide spread change over, septic tanks pumped every 4 years older infrastructure but do have special rates and hence funding for maintenance | 11 |

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|-------------------------------------|-----------------------|----------------------------------|--|---|----------------|---------------------------------|-------------------|--|------------------------|-------------------------|---|---------------------|
| Environment, water and public realm | Public realm | All open space | Utilisation of open space | Fire risk - increasing | 5 | High | 5 | Community unable to use open space during fire events and following fire if area burnt | 10 | 2 | Fuel reduction practices. Compliance on private land to make sure residents reduce fuel. Fuel reduction on public lands. CFS work in relation to asset protection. Public education programs regarding reporting suspicious behaviour, awareness regarding fuel reduction, preparedness. Bushfire hazard mapping. Have to protect given proximity to residential development. Not much person made infrastructure so trees will naturally regenerate. risk is restricted to hills face areas in TTG, Campbelltown and Burnside. Some parks formally closed on hire fire danger days. Not likely to be used in any case on hire fire danger days anyway. | 18 |
| Environment, water and public realm | Public realm | All open space | Utilisation of open space | Heatwaves - increased frequency and intensity | 5 | Moderate | 3 | Utilisation will greatly reduce during heat waves although expect to rebound following heat event | 8 | 4 | Open space management plans, reduce irrigate area and expand mulched/planted area, so makes attractive place to visit. Some open space has features which still attract use e.g. Tusmore Park wading pool, shade structures, vegetation, irrigation. Current sport and recreation planning versus open space planning and how balance provision in Council areas. Irrigation regimes for some open space areas. | 14 |
| Environment, water and public realm | Public realm | All open space | Utilisation of open space | Rainfall intensity - increasing | 3 | Moderate to High | 4 | Utilisation will greatly reduce during heavy rain events and possibly following events as flooding prevents access | 7 | 2 | Minimal opportunity to respond other than go indoors. Stormwater infrastructure can mitigate some flooding. May have more space for absorption of water, but some localised flooding. | 15 |
| Environment, water and public realm | Public realm | All open space | Utilisation of open space | Temperature - increased winter and spring | 4 | Low to Moderate | 2 | Use could actually increase in winter and spring if conditions more suitable for outdoor activities OPPORTUNITY | 6 | 7 | Potential for conflict over use | 9 |
| Planning, assets and infrastructure | Planning and heritage | Low density residential land use | Amenity and liveability of low density residential areas | Fire risk - increasing | 5 | High | 5 | Generally higher flammable vegetation cover which may be damaged or destroyed in fire, reducing amenity. Fire could destroy/damage housing. Smoke impact on residents. | 10 | 7 | Clearance of vegetation near houses reduces amenity. Dried out vegetation-need to water to reduce. Policies are in place that require protection in terms of design, fire fighting capability. Selection of materials. But some older development may not have these measures. Information and awareness of community regarding fire protection. Community is less experienced as have not had a fire in region for a while so less knowledge about being prepared. Some community members not heeding warnings, burning off during fire ban. Bushfire plans, emergency management planning. Development Plan policy regarding development in high risk areas and building code requirements. | 13 |
| Planning, assets and infrastructure | Planning and heritage | Low density residential land use | Amenity and liveability of low density residential areas | Heatwaves - increased frequency and intensity | 5 | Moderate to High | 4 | Amenity may be reduced as extreme heat affects plant health and vigour | 9 | 4 | More space around homes to landscape and provide vegetation, not tied in with a body corporate like might be in higher density. More options/space to install cooling measures e.g. shade structures. But there is a trend to build bigger homes on large blocks, boundary to boundary so reducing areas available for vegetation. Use more energy to cool homes. Less efficiency as may have less people per household. Impacts external to site might impact amenity e.g. power outages, transport disruption. May be less able to access social networks, services etc. due to car dependency. Vulnerable populations may be more dispersed if in low density housing. | 15 |
| Planning, assets and infrastructure | Planning and heritage | Low density residential land use | Amenity and liveability of low density residential areas | Rainfall - declining annual average | 2 | Moderate to High | 4 | Reduced rainfall and associated soil moisture may reduce plant health and vigour | 6 | 6 | Less ability to maintain gardens. Impact soil and result in cracking of homes, especially older homes. More options to implement options to capture and reuse of rainwater e.g. tank on site. Some Councils have development plan policy that requires rainwater tank to capture and reuse rainwater. Water prices may impact irrigation of private gardens. WSUD etc. to irrigate public realm. | 10 |

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| Planning, assets and infrastructure | Planning and heritage | Medium and high density residential land use | Amenity and liveability of medium and high density residential areas | Heatwaves - increased frequency and intensity | 5 | Moderate to High | 4 | Urban heat island effect felt more in higher density areas where less vegetation | 9 | 2 | AC dependent on income levels and ability to run air conditioning energy efficiency of existing buildings, large number of heritage buildings in region and are difficult to retrofit, restrictions about what can do. Shade/vegetation provides cooling but more dense areas have less ability to provide. Medium to higher density are often located along road corridors which add to UHI. Limited air movement, no sea breezes. Once in high density living less control over what can do to cool e.g. 3 storey. Older buildings take longer to heat up. If living in apartments may have less control over what can do to passively cool e.g. landscaping, vegetation. Park Lands, and other parks and reserves provide cooling to nearby areas. Some people have low knowledge about how to stay cool in heatwaves. Noise from other peoples air-conditioning and less likely to open windows to cool overnight. Safety concerns if have doors and windows left open to cool down. Amenity linked to ability to maintain power and no disruption. | 17 |
| Planning, assets and infrastructure | Planning and heritage | Medium and high density residential land use | Amenity and liveability of medium and high density residential areas | Rainfall - declining annual average | 2 | Moderate to High | 4 | Reduced rainfall and associated soil moisture may reduce plant health and vigour, higher density areas more sensitive as less vegetation so what is there is more important in maintaining amenity | 6 | 4 | Appropriate drought tolerant species selection. Water trucks to water street trees. Capture and reuse of water to irrigate green spaces external to residential sites. Rainwater tanks to service household needs. Other sources of water for irrigation. | 12 |
| Planning, assets and infrastructure | Planning and heritage | Medium and high density residential land use | Amenity and liveability of medium and high density residential areas | Rainfall intensity - increasing | 3 | Moderate to High | 4 | Higher impervious areas makes these areas more sensitive to flooding | 7 | 3 | Ageing stormwater infrastructure. Current infrastructure may not have correct capacity to cope with 2050. Urban stormwater master plan for the region yet to be finalised, but could provide a framework for regional options. Increased paved areas will increase runoff. Accessibility to transport, roads flooded etc. Existing soil types are not permeable. Proximity to existing watercourses-some development inappropriately located. WSUD, detention basins, wetlands. Lack of maintenance of water courses by private landholders to facilitate flow. Lack of space to accommodate techniques to manage flooding onsite, or area very costly e.g. underground tanks. | 14 |
| Planning, assets and infrastructure | Planning and heritage | Medium and high density residential land use | Amenity and liveability of medium and high density residential areas | Temperature - increase average | 4 | Moderate | 3 | Urban heat island effect felt more in higher density areas where less vegetation | 7 | 4 | May be an opportunity for warmer days in winter. AC dependent on income levels and ability to run air conditioning energy efficiency of existing buildings, large number of heritage buildings in region and are difficult to retrofit, restrictions about what can do. Shade/vegetation provides cooling but more dense areas have less ability to provide. Medium to higher density are often located along road corridors which add to UHI. Limited air movement, no sea breezes. Once in high density living less control over what can do to cool e.g. 3 storey. Older buildings take longer to heat up. If living in apartments may have less control over what can do to passively cool e.g. landscaping, vegetation. Park Lands, and other parks and reserves provide cooling to nearby areas. Some people have low knowledge about how to stay cool in heatwaves. Noise from other peoples air-conditioning and less likely to open windows to cool overnight. Safety concerns if have doors and windows left open to cool down. Amenity linked to ability to maintain power and no disruption. | 13 |

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| Planning, assets and infrastructure | Planning and heritage | State and local heritage items (built) | Condition of State and local heritage items (built items) | Rainfall - declining annual average | 2 | Moderate | 3 | Impact on soil moisture can lead to soil heavage and cracking of older buildings with poor foundations | 5 | 7 | Have lots of knowledge and understanding about what can do to manage/respond. But high costs can be associated with implementation. May result in more regular maintenance. selected state items have conservation management plans. Heritage funding schemes for owners. Legislation states that owners can not let places fall into disrepair-but never enforced. | 8 |
| Planning, assets and infrastructure | Planning and heritage | State and local heritage items (built) | Condition of State and local heritage items (built items) | Rainfall intensity - increasing | 3 | Moderate to High | 4 | Direct impact of rainfall and flooding is short term although buildings with old or already sensitive roofs could be more sensitive | 7 | 5 | Increased rainfall intensity is more of an issue, as existing problems can be exacerbated by intense rainfall events e.g. leaking roof. Have lots of knowledge and understanding about what can do to manage/respond. But high costs can be associated with implementation. May result in more regular maintenance. selected state items have conservation management plans. Heritage funding schemes for owners. Legislation states that owners can not let places fall into disrepair-but never enforced. Dependent on stormwater management plans. | 12 |
| Planning, assets and infrastructure | Planning and heritage | State and local heritage items (built) | Condition of State and local heritage items (built items) | Fire risk - increasing | 5 | High | 5 | Built assets highly sensitive to damage or destruction by bushfire | 10 | 7 | Clearance of vegetation near houses reduces amenity. Dried out vegetation-need to water to reduce. Policies are in place that require protection in terms of design, fire fighting capability. Selection of materials. But some older development may not have these measures. Information and awareness of community regarding fire protection. Community is less experienced as have not had a fire in region for a while so less knowledge about being prepared. Some community members not heeding warnings, burning off during fire ban. Bushfire plans, emergency management planning. Development Plan policy regarding development in high risk areas and building code requirements. | 13 |
| Planning, assets and infrastructure | Water assets | Stormwater management features (WSUD and wetlands) | Effective functioning of stormwater management features (WSUD, wetlands, basins, pumps) | Fire risk - increasing | 5 | Moderate | 3 | Above ground assets highly sensitive to damage or destruction by bushfire, more of impact from water quality reduced by increased SS as vegetation cover destroyed, interaction with increased rainfall intensity, also impact of fire retardant having high nutrient load and impact on WQ of downstream waterbodies, water quality impact on operation of MAR ability to inject | 8 | 1 | Council bushfire management plans do consider fuel load reduction to reduce fuel load and fire risk - just not looked at the moment Bushfire not currently considered in stormwater but may need to be in future Also greater requirement for maintenance following fire, trees and limbs could drop and block flow paths, response more focused on emergency response Upper catchments more likely to be affected by physical damage, downstream more water quality impacts | 17 |

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| Planning, assets and infrastructure | Water assets | Stormwater management features (WSUD and wetlands) | Effective functioning of stormwater management features (WSUD, wetlands, basins, pumps) | Heatwaves - increased frequency and intensity | 5 | Moderate | 3 | Vegetation associated with WSUD may be less sensitive to hot days as potentially greater soil moisture or surface water present | 8 | 2 | Currently WSUD vegetation and plantings not planned for long term irrigation, just during establishment Community awareness of wetland function and related amenity occurring eg Victoria Park Design standards improving but not regulated, need to look at species choice planned for current conditions Torrens Lake has higher profile so more resources and water mixing infrastructure to prevent stratification, monitoring in place, higher AC, political pressures on water flushes and releases from us and to downstream environment, Torrens Lake irrigation source for many open spaces, increased evaporation means changes to operation Amenity issues can be driver for community response and concern Change in direction to seeing stormwater management as green infrastructure not just water removal Reduced rainfall may result in | 16 |
| Planning, assets and infrastructure | Water assets | Stormwater management features (WSUD and wetlands) | Effective functioning of stormwater management features (WSUD, wetlands, basins, pumps) | Rainfall - declining spring | 5 | Moderate to High | 4 | Change to water regime of WSUD sites and water levels, and vegetation demand for water, increased maintenance costs Less water available for MAR recharge Lower soil moisture levels Likely to then also have greater damage from summer high intensity rainfall events Tree roots can be invasion in search for water | 9 | 2 | WSUD needs rain to function, might need to reconsider storage capacity within catchment, combined with increased temperature Current AC includes water carting to high profile areas, newly established areas but expensive and not sufficient for all areas | 17 |
| Planning, assets and infrastructure | Water assets | Stormwater management features (WSUD and wetlands) | Effective functioning of stormwater management features (WSUD, wetlands, basins, pumps) | Rainfall intensity - increasing | 3 | High | 5 | Water treatment not effective during high flows, infrastructure designed for low ARI events (1 in 10 year), slight change in rainfall intensity could have marked impact on condition and function of infrastructure Age of infrastructure key issue - not designed for greater events Greater density of building means also greater runoff | 8 | 1 | Very difficult to retrofit stormwater issues, action identified in SMPs but not costed, policy improvements re on site detention and WSUD known but not politically supported or resourced Not enough mandatory provisions for green infrastructure and WSUD in development plan Infill development challenges stormwater systems as volumes of stormwater generated increase | 17 |
| Planning, assets and infrastructure | Infrastructure | Walking and cycling paths | Effective functioning of walking and cycling paths | Fire risk - increasing | 5 | Low to Moderate | 2 | Fire damage could damage paths and damage adjoining vegetation, leading to path closures | 7 | 8 | More to do with maintenance. How quickly can you get the paths re-opened Not all of path network will be exposed to bushfire, so can move crews to different areas | 9 |
| Planning, assets and infrastructure | Infrastructure | Walking and cycling paths | Effective functioning of walking and cycling paths | Heatwaves - increased frequency and intensity | 5 | Low | 1 | Unsealed paths less sensitive, bitumen paths sensitive to extreme heat Limited traffic during periods of heat ave or fire risk | 6 | 7 | Concrete slabs can move so greater work to repair | 9 |

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| Planning, assets and infrastructure | Infrastructure | Walking and cycling paths | Effective functioning of walking and cycling paths | Rainfall intensity - increasing | 3 | Moderate | 3 | Erosion and flood damage may damage infrastructure making unsuitable for use Some paths closer to creek lines are more vulnerable | 6 | 5 | Already work happening to repair and maintain paths. May need to deal with higher rates of shrinkage and swell | 11 |
| Planning, assets and infrastructure | Infrastructure | Electricity transmission | Effective operation of electricity supply network | Fire risk - increasing | 5 | High | 5 | Direct destruction or damage to infrastructure, rolling or planned outages during fire events, SA Power Networks assets are burnt by bushfires as evidenced in 2005 at Wangary, 2013 at Cherryville and 2015 at Sampson Flat High Fire Danger days - greater risk of electricity grid fires hence we may need to switch off to mitigate this risk; high customer/community impacts | 10 | 3 | Without placing electricity plant/equipment underground, the grid will always be damaged by bushfires. High Fire Danger days Unless lines are undergrounded this risk will always exist. Cost effective and community sensitive adaptive strategies being proposed in current Reset submission to AER, and likely in future submissions | 17 |
| Planning, assets and infrastructure | Infrastructure | Electricity transmission | Effective operation of electricity supply network | Heatwaves - increased frequency and intensity | 5 | High | 5 | Power lines sag, fuses overload, increased electricity demand stresses the grid. Solar panels reduce some loading. | 10 | 4 | If National Electricity Market demand exceeds available supply, SAPN may be directed to Load Shed. Some critical loads are exempted - OTR approves these. Some private generation may be fed back into the grid during periods of peak demand. Pre-existing incentives for demand management | 16 |
| Planning, assets and infrastructure | Infrastructure | Electricity transmission | Effective operation of electricity supply network | Rainfall intensity - increasing | 3 | Moderate | 3 | Studies have been undertaken of effects of 1:100 year floods eg Brownhill Creek-Keswick flood plain. Some plant/equipment including in Substations, could be affected. This could interrupt supply in short term and some plant may need to be replaced | 6 | 2 | Very difficult to alter plant/equipment that could be exposed to such affects eg there are hundreds of ground level pits which contain electrical connections and these could be impacted by flooding. | 14 |
| Planning, assets and infrastructure | Water assets | Potable water supply | Effective operation of potable water supply (e.g. pipes and pumps) and treatment plants | Fire risk - increasing | 5 | Moderate | 3 | Infrastructure sensitive to damage or destruction from fire, associated power outages impact pump operation, water quality impacts from increased ash and sediment into reservoirs. | 8 | 8 | Ability to source water for Hope Valley supply from desal, increase cost associated, interconnectors all complete SA Water asset protection plans, emergency management plans and bushfire response plans. Back up generators at pump stations. | 10 |
| Planning, assets and infrastructure | Water assets | Potable water supply | Effective operation of potable water supply (e.g. pipes and pumps) and treatment plants | Heatwaves - increased frequency and intensity | 5 | Low to Moderate | 2 | Increase in demand for water during hotter temperatures may reduce mains water pressure | 7 | 8 | SA Water has emergency management plan to maintain water pressure. Key KPI for business. | 9 |
| Planning, assets and infrastructure | Water assets | Potable water supply | Effective operation of potable water supply (e.g. pipes and pumps) and treatment plants | Rainfall - declining annual average | 2 | High | 5 | Infrastructure sensitive to damage to underground infrastructure as result of soil heavage caused by changes in soil moisture Water supply greatly impacted by reduced rainfall - outside the region but important - Adelaide Hills catchments and River Murray | 7 | 8 | Desal plant provides alternate supply and can supply 100% water for metro region SA Water long term supply plans consider climate change and potential reduction in rainfall Integrated suply considers diverse souces, including wastewater reuse | 9 |
| Planning, assets and infrastructure | Water assets | Potable water supply | Effective operation of potable water supply (e.g. pipes and pumps) and treatment plants | Rainfall - declining spring | 5 | High | 5 | Infrastructure sensitive to damage to underground infrastructure as result of soil heavage caused by changes in soil moisture Water supply greatly impacted by reduced rainfall - outside the region but important - Adelaide Hills catchments and River Murray | 10 | 8 | Desal plant provides alternate supply and can supply 100% water for metro region SA Water long term supply plans consider climate change and potential reduction in rainfall Integrated suply considers diverse souces, including wastewater reuse | 12 |
| Planning, assets and infrastructure | Water assets | Potable water supply | Effective operation of potable water supply (e.g. pipes and pumps) and treatment plants | Rainfall intensity - increasing | 3 | Low to Moderate | 2 | Less sensitive to contamination from stormwater or sewer as result of closed supply system, monitoring ongoing and dosing maintains potable supply | 5 | 8 | SA Water Asset management plans do consider CC. Water quality impacts as more erosion in smaller water courses from intensive events. (for water entering treatment plants) | 7 |
| Planning, assets and infrastructure | Infrastructure | Roads | Effective operation of road network | Fire risk - increasing | 5 | Moderate | 3 | Direct damage to roads, trees or branches can fall over road, road closures during fire and closures to repair following fire. Burned out signage can influence effective operation of road network | 8 | 6 | There are detours that can be established. Shutdown of the road is for a short period of time. Limited resources within DPTI to be able to assess vegetation after the fire. Needed consulting arborists. There is a central coordination unit. Resources are stretched during the event. | 12 |

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| Planning, assets and infrastructure | Infrastructure | Roads | Effective operation of road network | Heatwaves - increased frequency and intensity | 5 | Moderate | 3 | Impact of heat on bitumen can melt and require closure or repair More people tend to use the roads on hot days | 8 | 9 | Asphalt can tolerate high temps (60-80°C). New roads can be vulnerable when first laid. Road surface can harden up once laid for a longer period | 9 |
| Planning, assets and infrastructure | Infrastructure | Roads | Effective operation of road network | Rainfall - declining annual average | 2 | Moderate to High | 4 | Impact on soil moisture can lead to soil heavage and impacts on road surfaces Biggest enemy to road network are water mains, sewage network Longer dry spells are important | 6 | 3 | Limited adaptive capacity within current budgets | 13 |
| Planning, assets and infrastructure | Infrastructure | Roads | Effective operation of road network | Rainfall intensity - increasing | 3 | Moderate to High | 4 | Flood damage or erosion could damage roads or bridges etc, storm damage also likely associated with high intensity rainfall event | 7 | 7 | Increasing flood risk won't affect the entire region equally. Shorter time period of extreme rainfall event. | 10 |
| Planning, assets and infrastructure | Water assets | Wastewater treatment (SA Water) | Effective operation of SA Water wastewater treatment network (e.g. pipes and pumps) | Fire risk - increasing | 5 | Low to Moderate | 2 | Above ground assets (pump stations) highly sensitive to damage or destruction by bushfire, also power outages may impact pumps | 7 | 8 | SA Water have bushfire management plans -associated power outages likely to be greatest problem for ww treatment emergency management plans. Back up generators at pump stations. Ability to divert sewer network, replace pump or manual cartage. Majority gravity fed sewer network. | 9 |
| Planning, assets and infrastructure | Water assets | Wastewater treatment (SA Water) | Effective operation of SA Water wastewater treatment network (e.g. pipes and pumps) | Rainfall - declining annual average | 2 | Moderate | 3 | Damage to underground infrastructure as result of soil heavage caused by changes in soil moisture Benefit from reduced potential for stormwater inflows to wastewater system Tree roots also cause problems | 5 | 5 | Likely to be beneficial for stormwater inflows to ww Problems with soil moisture reduction and cracking with reduced rainfall | 10 |
| Planning, assets and infrastructure | Water assets | Wastewater treatment (SA Water) | Effective operation of SA Water wastewater treatment network (e.g. pipes and pumps) | Rainfall intensity - increasing | 3 | Moderate to High | 4 | Flooding results in sewer overflow, potential contamination, overload of stormwater transfer, existing ww network been prone to flood inundation and high downstream runoff | 7 | 8 | Infrastructure upgrade programs for pump stations | 9 |
| Planning, assets and infrastructure | Infrastructure | Public transport (buses, rail, busway, tram) | Increased use of public transport services | Fire risk - increasing | 5 | Moderate | 3 | Services may be cancelled or unable to service some areas in event of a fire | 8 | 6 | Periodic shutdown of roads will have an impact. Some roads will need to be re-routed | 12 |
| Planning, assets and infrastructure | Infrastructure | Public transport (buses, rail, busway, tram) | Increased use of public transport services | Heatwaves - increased frequency and intensity | 5 | Moderate to High | 4 | Rail and tram lines may buckle, buses without adequate air-conditioning not suitable for passengers or drivers, changes to scheduling in extreme heat, making people less likely to consider using public transport | 9 | 4 | Continuous welding of lines means that buckling is less of an issue. Services can be delayed during heat wave which is to allow additional time for cabins to reach preferred temperature. Public transport has priority electricity feeds. Quality of the ride goes down. Buses are contracted out to a private operator. Cost of servicing broken down buses may go up if the frequency of call outs increases | 15 |
| Planning, assets and infrastructure | Infrastructure | Public transport (buses, rail, busway, tram) | Increased use of public transport services | Rainfall intensity - increasing | 3 | Low to Moderate | 2 | Disruption to routes, short term interruption, less likely to impact increasing use by community | 5 | 9 | Increased risk of accidents, slower traffic. May require more maintenance on the ballast of rail line | 6 |
| Environment, water and public realm | Biodiversity and water resources | Natural watercourses (biodiversity and amenity) | Condition of natural watercourses (biodiversity and amenity) | Rainfall - declining summer | 2 | Moderate to High | 4 | | 6 | 2 | Low flow bypass may prove more difficult to implement in summer | 14 |
| Environment, water and public realm | Biodiversity and water resources | Natural watercourses (biodiversity and amenity) | Condition of natural watercourses (biodiversity and amenity) | Rainfall - declining spring | 5 | Moderate to High | 4 | | 9 | 4 | There is some capacity through the provision of environmental flows. Consideration is also being given to low flow options. | 15 |
| Community well being and economic prosperity | Vulnerable members of the community | Low income individuals and/or families | Low income individuals and/or families | Heatwaves - increased frequency and intensity | 5 | Moderate to High | 4 | Inability pay for cooling. If homeless, unable to get into places that are cool or, live in houses that are less prepared for extreme heat. Less tree cover in these areas as well. Lack of transport options can be an issue, especially if living in fringe suburbs. | 9 | 3 | This group does not have ability to pay to find refuges during events. Limited ability to recover. Knowledge of the event can be higher than for other vulnerable members of the community. Cost of water will become a bigger issue, although depends on whether you are renting.. | 16 |
| Community well being and economic prosperity | Vulnerable members of the community | Low income individuals and/or families | Low income individuals and/or families | Fire risk - increasing | 5 | Moderate to High | 4 | | 9 | 2 | Ability to react to a fire may be higher, but response afterward will be influenced by how much help they have access to. | 17 |
| Community well being and economic prosperity | Vulnerable members of the community | Low income individuals and/or families | Low income individuals and/or families | Rainfall intensity - increasing | 3 | Moderate | 3 | | 6 | 4 | | 12 |

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| Planning, assets and infrastructure | Infrastructure | Built assets- houses | Thermal performance of housing (comfort levels for tenants and reduce impacts for heat waves) | Heatwaves - increased frequency and intensity | 5 | Moderate to High | 4 | | 9 | 6 | Moderate AC of current housing stocks. | 13 |
| Planning, assets and infrastructure | Infrastructure | Built assets- houses | Thermal performance of housing (comfort levels for tenants and reduce impacts for heat waves) | Average increase in temperature | 4 | Moderate | 3 | | 7 | 6 | Moderate AC of current housing stocks. | 11 |
| Planning, assets and infrastructure | Infrastructure | Built assets | Effective operation of Government owned built assets (e.g. community, sporting, recreational, school facilities) | Heatwaves - increased frequency and intensity | 5 | Moderate | 3 | Most facilities have air-conditioners More people will use Government owned built assets Campbelltown library was open as a designated cool area. One evening stayed open longer than normal to provide heat refuge. These were advertised in the local media. | 8 | 7 | | 11 |
| Planning, assets and infrastructure | Infrastructure | Built assets | Effective operation of Government owned built assets (e.g. community, sporting, recreational, school facilities) | Fire risk - increasing | 5 | Low to Moderate | 2 | | 7 | 8 | Purpose of operation may change if centres become used as evacuation drop off points | 9 |
| Planning, assets and infrastructure | Infrastructure | Built assets | Effective operation of Government owned built assets (e.g. community, sporting, recreational, school facilities) | Rainfall intensity - increasing | 3 | Moderate | 3 | Risk of water getting into the building | 6 | 9 | | 7 |
| Planning, assets and infrastructure | Infrastructure | Built assets | Effective operation of Government owned built assets (e.g. community, sporting, recreational, school facilities) | Rainfall - declining spring | 5 | Moderate to High | 4 | Building cracking and maintenance. Old buildings will be more susceptible to future dry trends | 9 | 7 | Periodic closures for maintenance | 12 |
| Environment, water and public realm | Parks and reserves | Irrigated open space (including sports grounds and parks) | Amenity, character and recreation opportunities provided by irrigated open space | Temperature - increased summer and autumn | 5 | Moderate to High | 4 | Recreational opportunities on hot days may be impacted, | 9 | 4 | Looking at changing tree species selection but not well resourced, impacts lighting, permanent structures | 15 |