



AdaptWest

Integrated Vulnerability Assessment Report
August 2015



URPS in collaboration with SEED consulting and AECOM



AdaptWest Integrated Vulnerability Assessment Report

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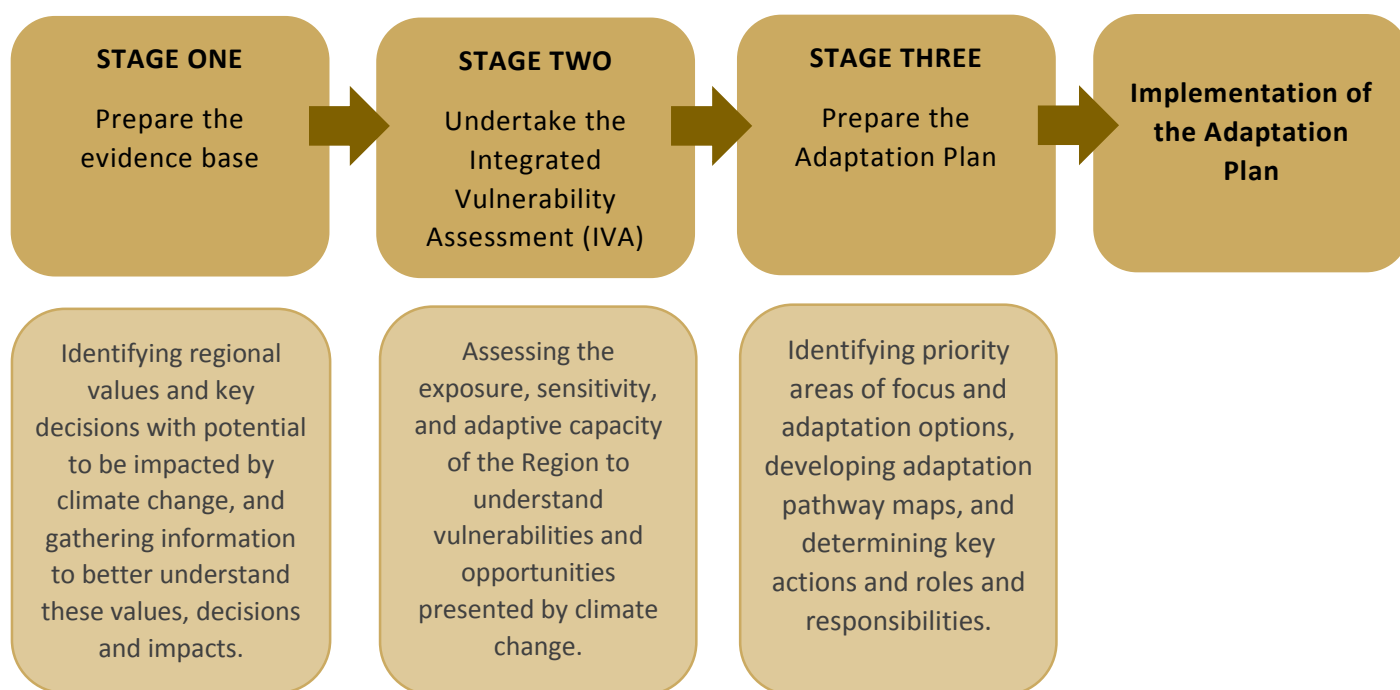
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The Western Adelaide Region Climate Change Adaptation project is supported and co-funded by contributions from the Commonwealth Govt per the Natural Disaster Resilience Program, SAFECOM, the SA Dept Environment, Water, and Natural Resources, and the Cities of Charles Sturt, West Torrens , and Port Adelaide Enfield

Executive Summary

AdaptWest is a partner project between the Cities of Port Adelaide Enfield, Charles Sturt and West Torrens and the South Australian and Australian Governments to develop and implement a Regional Climate Change Adaptation Plan for Western Adelaide. The Regional Climate Change Adaptation Plan is being delivered through three main stages as shown below:

AdaptWest Project Stages



This report summarises the outcomes of Stage Two.

As part of Stage Two, an Integrated Vulnerability Assessment (IVA) was undertaken for AdaptWest to identify priority areas for focussing adaptation planning. The IVA is a tool that assists with understanding how:

- Climate change may impact valued aspects or features in the Region; and
- Particular valued aspects or features that 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, AdaptWest 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 implement the IVA, the approach to analysing the results of the IVA and proposed priority areas of focus for the third stage of the project relating to the preparation of the Regional Climate Change Adaptation Plan.

Table 1 Indicators identified by the analysis of the IVA

Indicators to inform focus of adaptation planning
Condition and extent of beaches and dunes
Condition and extent of native vegetation cover by vegetation type
Condition of benthic habitat (e.g. sea grass, pests)
Condition of built cultural heritage (e.g. heritage buildings, bridges, monuments, public art)
Contribution to Gross Regional Product (Western Adelaide Region)
Effective functioning of active recreation and sporting sites (indoor and outdoor)
Effective functioning of built assets and contents (houses)
Effective functioning of cycling and walking infrastructure (e.g. footpaths etc.)
Effective functioning of recreation facilities (e.g. Surf Life Saving Clubs, playgrounds)
Effective functioning of stormwater management infrastructure (drains, gutters, pipes)
Effective operation of built assets and contents (business and industry)
Effective operation of coastal assets
Effective operation of electricity supply
Effective operation of rail network
Effective operation of road network
Incidence of anti-social behaviour
Incidence of social behaviour-Neighbourly interactions
Members of the community living with mental health problems
Members of the community who require assistance for core activities
Members of the community with poor self-assessed health
Older members of the community (aged >75)
Potential for future industrial development
Quality of water – coastal/estuaries
Quality of water - inland waters

Transitioning from the IVA to adaptation planning

AdaptWest is using adaptation pathways analysis to prepare the Regional 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’.

For AdaptWest, 13 key areas of decision making are proposed (refer Table 2). The key areas of decision making have been identified by considering:

- How the indicators from the IVA analysis can be grouped by theme;
- Why the indicators scored more highly in terms of vulnerability; and
- The values of the Western Adelaide Region.

Table 2 AdaptWest key areas of decision making

Theme	Key area of decision making
Vulnerable members of the community	How do we improve the health, safety and wellbeing of vulnerable members of the community to cope better with extreme events such as more frequent and intense heatwaves and flooding?
Public coastal built assets	How do we provide, protect and manage public coastal and inland assets as the sea level rises?
Open and green spaces and recreation	How do we provide, protect and manage open and green spaces as we experience warmer and drier conditions, more frequent and intense heatwaves and the sea level rises?
Natural landscapes-coastal	How do we protect and enhance the condition of natural coastal landscapes as the sea level rises?
Natural landscape-estuarine	How do we protect and enhance the condition of natural estuarine landscapes as the sea level rises?
Urban living	How do we create better amenity and liveability in our urban areas as our climate becomes warmer and drier, we experience more frequent and intense heatwaves, rainfall intensity increases and the sea level rises?
Stormwater management infrastructure	How do we design, construct and maintain stormwater management infrastructure as annual rainfall declines, rainfall intensity increases and the sea level rises?
Community connectedness	How do we build a strong and connected community as we experience more frequent and intense heatwaves and flooding?
Business and industry	How do we enable business and industry to prosper as rainfall intensity increases, heatwaves increase in frequency and intensity and the sea level rises?
Transport and essential services	How do we minimise disruption to transport and essential services as we experience more frequent and intense heatwaves, increased rainfall intensity and sea level rise?
Inland waters	How do we maintain the amenity and function of inland waters as we experience more frequent and intense heatwaves, rainfall intensity increases and the sea level rises?
Estuarine waters	How do we maintain the amenity and function of estuarine waters as we experience more frequent and intense heatwaves, rainfall intensity increases and the sea level rises?

Next steps

The third task of the AdaptWest project 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 Regional 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.



1.0 Introduction

1.1 About AdaptWest

AdaptWest is a partner project between the Cities of Port Adelaide Enfield, Charles Sturt and West Torrens and the South Australian and Australian Governments to develop and implement a Regional Climate Change Adaptation Plan for Western Adelaide.

In 2013, an initial stage of work was completed comprising a social, economic and environmental profile of the Western Adelaide Region, and collation of historical climate observations and future climate projections¹.

AdaptWest builds upon this previous work and is being delivered through three main tasks:

- **Preparing the evidence base** - Identifying regional values and key decisions with potential to be impacted by climate change, and gathering information to better understand these values, decisions and impacts;
- **Undertaking the Integrated Vulnerability Assessment (IVA)** – Assessing the exposure, sensitivity, and adaptive capacity of the Region to understand vulnerabilities and opportunities presented by climate change; and
- **Preparing the Adaptation Plan** – Identifying priority areas of focus and adaptation options, developing adaptation pathway maps, and determining key actions and roles and responsibilities.

The project's methodology embeds the active participation of key stakeholders from the Western Adelaide Region. Specifically, this involves interactive stakeholder workshops associated with each project task, and direct stakeholder input to key project decisions relating to the focus of the project, the assessment of vulnerability, and preferred adaptation responses.

1.2 Role of this report

This report is the culmination of work undertaken in task two of AdaptWest and utilises and builds on information collected in task one including five research papers² relating to the following themes:

- Assets, infrastructure and economy;
- Coastal management;
- Environment and open space;
- Social and community resilience and health; and
- Urban planning and development.

¹ SKM (2013) *Western Adelaide Region Climate Change Adaptation Plan – Stage 1*

² Research papers are available at www.portenf.sa.gov.au



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

- Methodology used to implement the IVA;
- Approach to analysing the results of the IVA; and
- Priority areas of focus for the third task of AdaptWest relating to the preparation of the Regional Climate Change Adaptation Plan.

2.0 What is an Integrated Vulnerability Assessment?

An Integrated Vulnerability Assessment (IVA) is a tool that helps to identify areas of vulnerability to the impacts of climate change and 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). Although the IVA is focused on understanding those aspects that might be particularly vulnerable to the impacts of climate change, the assessment process can also assist in identifying opportunities where aspects or features may benefit from particular climate change impacts.

Table 3 Definitions of key terms

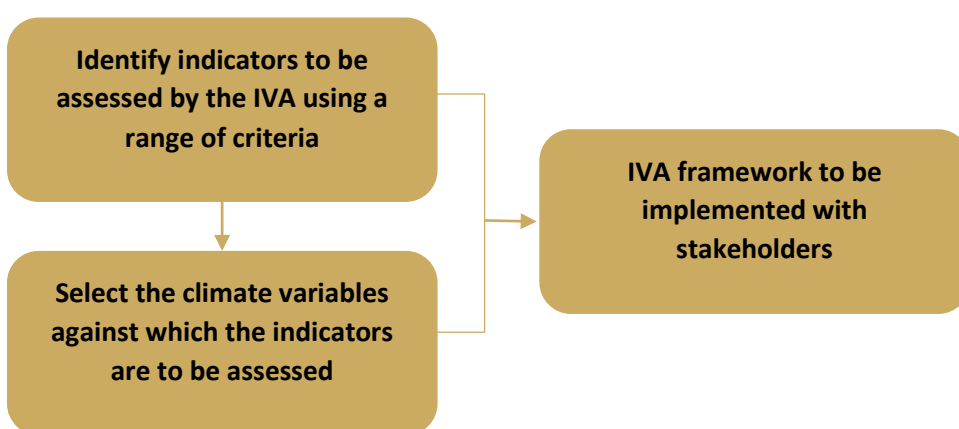
Term	Definition
Climate variable	Climate variable refers to different climate impacts projected for a particular timeframe and include coastal inundation, reduced rainfall, rainfall intensity, temperature increase, increased frequency of heatwaves, increased temperature of Gulf waters etc. For AdaptWest, exposure relates to predicted changes in the climate at 2070.
Exposure	Exposure considers the likelihood of a feature or its function being subjected to a climate variable. For example, beaches are exposed to coastal inundation, the entire Region is exposed to heatwaves and low lying areas are more exposed to flood inundation. .
Sensitivity	<p>Sensitivity considers the degree to which a feature or its functions are affected by a climate variable.</p> <p>For example, older people are sensitive to heatwaves, dunes are sensitive to coastal inundation, some marine species are sensitive to increased water temperature of Gulf St Vincent.</p>
Adaptive capacity (to cope with 2070 conditions)	<p>Adaptive capacity is the ability of a feature or system to adjust to climate change impacts (including climate variability and extremes) to moderate potential damages, take advantage of opportunities, or cope with consequences.</p> <p>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 2070.</p> <p>For example, a sea wall can protect buildings along the coast, but if no sea wall was in place now, then the adaptive capacity would be considered to be less than if a sea wall was currently in place</p>
Integrated Vulnerability Assessment	The Integrated Vulnerability Assessment (IVA) is a process for assessing vulnerabilities to climate change by considering exposure, sensitivity and adaptive capacity.

2.1 How was the IVA developed?

The IVA is a process identified by the State's Adaptation Framework³ for implementation in preparing regional adaptation plans and further described in the Local Government Association of South Australia Climate Adaptation Planning Guidelines⁴. The approach described in the Guidelines was used to develop the IVA framework used for Adapt West has been used by Government regions across South Australia.

Developing the IVA framework involved two key steps as summarised by Figure 1 and described in more detail below.

Figure 1 Key steps to developing the IVA framework



2.1.1 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 having reference to the values identified by stakeholders in task one of AdaptWest. These values comprise:

- Amenity and quality of life;
- A strong and connected community;
- Biodiversity;
- Coastal and riverine water quality;
- Coastal environment;
- Infrastructure and essential services;
- Management and use of stormwater; and
- Regional productivity and economic contribution to the State.

³ Government of South Australia (2012) *Prospering in a Changing Climate: A Climate Change Adaptation Framework for South Australia*

⁴ Local Government Association of South Australia (2014) *Climate Adaptation Planning Guidelines*

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 (refer example in Table 4).

In total 51 indicators were assessed by the AdaptWest IVA and are listed in Appendix A. Appendix A also shows the relationship of each indicator to the AdaptWest values.

Table 4 Integrated assessment process (example)

Regional value	Features or aspects which contribute to this value	Links with other values	Indicators identified to assess this value via the IVA
Coastal environment	Beaches, dunes and vegetation Opportunities for recreation Tourist attraction Location of a range of assets and infrastructure	Biodiversity Coastal and riverine water quality Management and use of stormwater Amenity and quality of life Regional productivity and economic contribution to the State	Quality of water – coastal/estuaries Condition and extent of beaches and dunes Condition and extent of native vegetation cover by vegetation type Populations of significant native fauna and flora species Condition of benthic habitat (eg sea grass, pests) Condition of coastal recreation facilities (eg SLSC, playgrounds) Condition of tourist facilities (eg Henley Square, Port Wharf markets, Adelaide Shores etc) Condition of jetties and boat ramps Condition of built assets (eg houses, business, industry etc) Condition of cycling and walking infrastructure (e.g. footpaths etc.)

2.1.2 Selection of climate variables

The second step in developing the IVA framework involved identifying the climate variables to be used in the assessment of the indicators. Climate variables describe various aspects of the future climate such as:

- Average maximum and minimum temperatures
- Temperature at different times of the year e.g. summer versus winter
- Frequency and intensity of heatwaves
- Quantity and seasonality of rainfall
- Intensity of extreme rainfall events
- Sea level rise
- Water temperatures in the Gulf St Vincent
- Acidification of the waters of Gulf St Vincent

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 for AdaptWest, 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 AdaptWest project it was agreed by the Project Steering Group that the climate variables used by the IVA be based on the following:

- Medium emissions scenario;
- Median model output; and
- Timeframe of 2070.

Table 5 summarises the climate variables used by the AdaptWest IVA based on this approach⁵.

Table 5 Climate variables used by the IVA

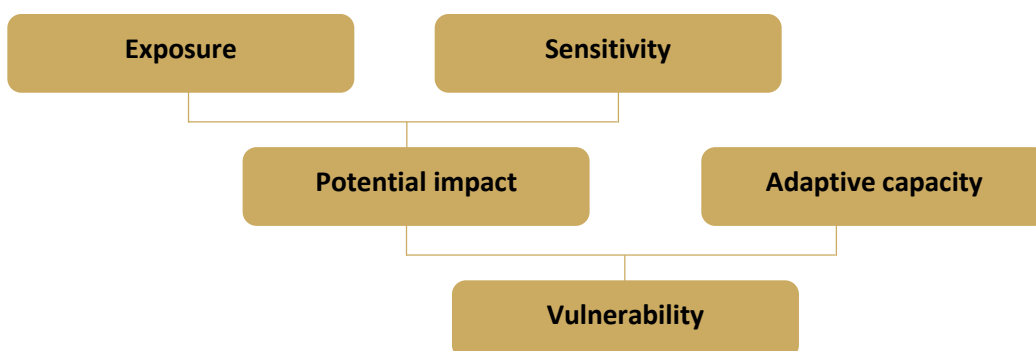
Climate Variable	Description
Temperature increases: Winter-spring	An increase in average annual temperatures of up to 2°C (1-2.5°C) is projected in winter and 2°C (1-3°C) in spring across the Region by 2070.
Temperature increases: Summer-autumn	An increase in average annual temperatures of up to 2°C (1-3°C) is projected in summer-autumn across the Region by 2070.
Rainfall Reduction: Winter-spring	Average winter rainfall predicted to decrease by up to 20% (5-20%) and spring rainfall by up to 20% (10-40%) below 1990 levels by 2070.
Rainfall Reduction: Summer-autumn	Average summer rainfall predicted to decrease by up to 10% (2 to 10%) and autumn by up to 5% (2 to 10%) below 1990 levels by 2070.
Sea level rise	Global mean sea level rise for 2046–2065 relative to 1986–2005 could be 0.26 m for more moderate emissions outlooks and up to 0.48 m by 2081–2100.
Sea surface temperatures	By 2046–2065 warming of the ocean could result in a 1.4°C rise in global sea surface temperatures under a medium emissions outlook relative to 1986–2005 and a 1.8–2.2°C rise by 2081–2100.
Increased ocean acidity	Projections for decreasing pH range from 0.06 to 0.32 pH units by 2100, with a best estimate more likely to be in the order of a 0.2 pH unit decrease.
Increased heatwave frequency and intensity	Sequences of three or more consecutive days with average temperatures of at least 32°C are projected to increase from 1 in 20 years under the baseline period to one in every 3-5 years under a low emissions scenario in 2070 and every year under a high emissions scenario by 2070.
Increased intensity of rainfall	Climate models suggest that for each degree of global warming, extreme daily rainfall may increase by 7%.

⁵Refer AdaptWest (2014) *Identifying climate variables for use by the Integrated Vulnerability Assessment for the Western Adelaide Region* and SKM (2013) *Western Adelaide Region Climate Change Adaptation Plan – Stage 1* for more information.

To complete the IVA, scores are assigned to rate how exposed something is to a climate variable (e.g. increased heatwave frequency and intensity or sea level rise) and how sensitive something 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 a feature or its function to cope or adjust. Figure 2 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. These calculations follow the approach described in the LGA *Climate Adaptation Planning Guidelines*⁶.

Figure 2 Integrated Vulnerability Assessment



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:

$$\text{Vulnerability} = \text{Potential impact} - \text{Adaptive Capacity} + 10 = /19$$

Figure 3 shows how the IVA framework is used to assess an indicator. In this example the indicator is 'members of the community living in public housing' 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. the climate variable related to increasing ocean acidity will be relevant to an indicator about seagrass condition, but not to an indicator related to vulnerable members of the community), and an initial step in implementing the IVA framework involves identifying those climate variables that are relevant to the indicator being considered.

⁶ Local Government Association of South Australia (2014) *Climate Adaptation Planning Guidelines*

**Figure 3 Example of how the IVA framework assesses an indicator**

Indicator: Members of the community living in public housing							
Climate variable	Exposure score	Sensitivity score	Comment	Potential impact score	Adaptive capacity score	Comment	Vulnerability score
Heat wave-increased frequency and intensity	5	5	Households without air-conditioning or concerned about cost of operating air-conditioners more sensitive. Public housing often has less green areas outside due to cost of maintaining and irrigating	10	3	Limited air-conditioning in public housing. Design standards of older housing stock are poorer.	17

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

A score out of 5 is assigned to how sensitive the indicator is to the 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 AdaptWest 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 AdaptWest 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 and identifying elements that contributed to adaptive capacity based on the information contained in the task one research papers.
- 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:

- Environment and natural resources;
- Economy and infrastructure; and
- Social and community.

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

3.0 Analysing the IVA

The IVA is a tool that can assist with understanding those aspects or features of the Western Adelaide 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 the AdaptWest project, the IVA must be analysed. There are a range of ways to analyse the IVA and this section of the report summarises the approach undertaken for AdaptWest.

In total, four approaches were applied to analysing the IVA as follows:

- Identifying indicators that had an average vulnerability of 16 and over (i.e. averaging the vulnerability score for one indicator across all climate variables and relevant features);

Identifying indicators that had a maximum individual vulnerability score of 18 or over (i.e. one of the features assessed against one climate variable scored 18 or over);

- Identifying indicators that had an average vulnerability score of 16 and over or a maximum individual vulnerability score of 18 or over; and
- Identifying indicators where individual aspects or features had an average vulnerability score of 16 and over or a maximum individual vulnerability score of 18 or over.

Table 6 shows the results of this analysis. Refer Appendix C for individual tables showing the four approaches described above.

Table 6 Indicators identified by the analysis of the IVA

Indicators to inform focus of adaptation planning
Condition and extent of beaches and dunes
Condition and extent of native vegetation cover by vegetation type
Condition of benthic habitat (e.g. sea grass, pests)
Condition of built cultural heritage (e.g. heritage buildings, bridges, monuments, public art)
Contribution to Gross Regional Product (Western Adelaide)
Effective functioning of active recreation and sporting sites (indoor and outdoor)
Effective functioning of built assets and contents (houses)
Effective functioning of cycling and walking infrastructure (e.g. footpaths etc.)
Effective functioning of recreation facilities (e.g. Surf Life Saving Clubs, playgrounds)
Effective functioning of stormwater management infrastructure (drains, gutters, pipes)
Effective operation of built assets and contents (business and industry)
Effective operation of coastal assets
Effective operation of electricity supply
Effective operation of rail network
Effective operation of road network
Incidence of anti-social behaviour

**Indicators to inform focus of adaptation planning**

Incidence of social behaviour-Neighbourly interactions
Members of the community living with mental health problems
Members of the community who require assistance for core activities
Members of the community with poor self-assessed health
Older members of the community (aged >75)
Potential for future industrial development
Quality of water – coastal/estuaries
Quality of water - inland waters

3.1 Understanding the analysis of the IVA

Based on the analysis documented in section 3 the indicators scoring higher vulnerability and their associated features or aspects have been grouped under common themes. Table 7 summarises this process and identifies the following for each theme:

- Indicators relevant to the theme;
- Particular features and aspects relevant to the indicator and theme; and
- Key climate variables that the key features and aspects that are valued are vulnerable to.

**Table 7 Indicators by theme, features and key climate variables**

Theme	Relevant indicators from IVA analysis	Key features or aspects	Key climate variables that they are most vulnerable to
Vulnerable members of the community (i.e. those living with mental health issues or poor health or needing assistance with core activities eg frail aged or people with a disability)	<p>Members of the community who require assistance for core activities</p> <p>Members of the community living with mental health problems</p> <p>Members of the community with poor self-assessed health</p> <p>Older members of the community (aged >75)</p>	<p>Members of the community who require assistance for core activities</p> <p>Members of the community living with mental health problems</p> <p>Members of the community with poor self-assessed health</p> <p>Older members of the community (aged >75)</p>	<p>Increased frequency and intensity of heatwave</p> <p>Increased rainfall intensity</p>
Public coastal built assets (eg paths, jetties, boat ramps, Surf Life Saving Clubs)	<p>Effective functioning of recreation facilities (e.g. SLSC, playgrounds)</p> <p>Effective functioning of cycling and walking infrastructure (e.g. footpaths etc.)</p> <p>Effective functioning of active recreation and sporting sites (indoor and outdoor)</p> <p>Effective operation of coastal assets</p> <p>Condition of built cultural heritage (e.g. heritage buildings, bridges, monuments, public art)</p>	<p>Surf Life Saving Clubs</p> <p>Cycling and walking infrastructure</p> <p>Beach access paths</p> <p>Jetties</p> <p>Boat ramps</p> <p>Marina</p> <p>Existing sea walls</p> <p>Built cultural heritage</p>	<p>Sea level rise</p>
Open and green spaces and recreation areas (eg playgrounds, indoor and outdoor recreation sites, street trees and landscaped public realm)	<p>Effective functioning of active recreation and sporting sites (indoor and outdoor)</p> <p>Effective functioning of cycling and walking infrastructure (e.g. footpaths etc.)</p> <p>Effective functioning of public realm (green assets - trees and landscaping)</p>	<p>Indoor facilities</p> <p>Cycling and walking infrastructure</p> <p>Playgrounds</p> <p>Outdoor grassed facilities (including irrigated areas)</p> <p>Outdoor paved/hard facilities</p> <p>Open space</p> <p>Green assets - trees and landscaping</p>	<p>Increased frequency and intensity of heatwave</p> <p>Sea level rise</p> <p>Reduced rainfall</p> <p>Temperature increase</p>



Theme	Relevant indicators from IVA analysis	Key features or aspects	Key climate variables that they are most vulnerable to
Natural landscapes-coastal	Condition and extent of beaches and dunes Condition and extent of native vegetation cover by vegetation type	Beaches without backshore vegetated dunes Beaches with backshore vegetated dunes south of Bower Road Beaches with backshore vegetated dunes north of Bower Road Coastal shrubland and remnant dune vegetation (including Spinifex grassland) Mangroves Samphire shrubland	Sea level rise
Natural landscape-estuarine	Condition and extent of native vegetation cover by vegetation type	Mangroves Samphire shrubland	Sea level rise
Urban living	Effective functioning of built assets and contents (houses)	Public housing - buildings and contents Houses / residential buildings and contents (privately owned) - Older houses with lower finished floor levels Houses / residential buildings and contents (privately owned) - Newer houses with higher finished floor levels	Increased frequency and intensity of heatwave Sea level rise Reduced rainfall Temperature increase Increased rainfall intensity
Stormwater management infrastructure	Effective functioning of stormwater management infrastructure (drains, gutters, pipes)	Above ground infrastructure (gutters, drains, pump stations) Below ground infrastructure	Reduced rainfall Sea level rise Increased rainfall intensity
Community connectedness	Incidence of social behaviour- Neighbourly interactions	Neighbourly interactions	Increased frequency and intensity of heatwave Increased rainfall intensity
Business and industry	Contribution to Gross Regional Product Effective operation of built assets and contents (business and industry) Potential for future industrial development	Commercial and industrial buildings (private) Small-Medium Enterprises (SME) Commercial and industrial buildings (private) Larger enterprises	Increased rainfall intensity Sea level rise



Theme	Relevant indicators from IVA analysis	Key features or aspects	Key climate variables that they are most vulnerable to
Transport and essential services	Effective operation of rail network Effective operation of road network Effective operation of electricity supply	Electricity infrastructure Road infrastructure Rail infrastructure	<ul style="list-style-type: none"> Increased frequency and intensity of heatwave <p>Increased rainfall intensity Sea level rise</p>
Inland waters	Quality of water - inland waters	River Torrens West Lakes Other watercourses	Increased frequency and intensity of heatwave Increased rainfall intensity Sea level rise
Estuarine waters	Quality of water – coastal/estuaries	Port River Barker Inlet/Lipson Reach Gulf St Vincent waters	Increased frequency and intensity of heatwave Increased rainfall intensity Sea level rise

It should be noted that there was one indicator that featured in the analysis but has not explicitly come through to the identified themes for adaptation planning in stage three of the project:

- Condition of benthic habitat (e.g. sea grass, pests)

Consideration of the benthic habitat will not be taken explicitly through to the next stage of the project as during the implementation of the IVA, stakeholders identified that there is very limited action that can be taken given that the impacts on benthic habitat are driven by changes in ocean acidity and temperature. Further, threats to the condition of benthic habitat including poor water quality of discharges to the marine environment are likely to be covered under the proposed stormwater management theme.

During the analysis of the IVA the scores assigned to the indicator *groundwater quantity and quality (for use by industry)* were reviewed. A discussion with Natural Resources Adelaide and Mount Lofty Ranges indicated that recent investigations undertaken for the development of the Water Allocation Plan for the Central Adelaide Region have shown that groundwater level and salinity is much less sensitive to rainfall and recharge than understood by the workshop attendees and indicated by the sensitivity score of 5 assigned to it⁷. The information received led to a revision of the sensitivity score to 2 – Low to Moderate. This change meant the vulnerability of groundwater to reduced rainfall was not high enough for this to be identified as a priority areas to focus adaptation planning in the Region. It was confirmed that increasing demand for groundwater for irrigation was likely to be a vulnerability for the Region. This will be addressed via consideration via the theme of open and green spaces and recreation areas.

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. An indicator can receive a low sensitivity score if it is resilient to the climate change variable being assessed or if it has high adaptive capacity. However, if the indicator being considered may benefit from a given climate impact (i.e. an opportunity), 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.

⁷ J. Awbery 2015 pers.comm. 4 August.

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

- Outdoor paved /hard surface facilities are less sensitive to reduced rainfall and have higher adaptive capacity due to existing asset management arrangements;
- Mangroves and samphire shrubland are less sensitive to reduced rainfall in summer-autumn than to sea level rise;
- The buildings and contents of schools and libraries are less sensitive to the increased frequency and intensity of heatwaves and have higher adaptive capacity due to asset management plans, design techniques and insurance;
- The Adelaide Airport has higher adaptive capacity to manage increased frequency and intensity of heatwaves due to design features and procedures to back up energy supply and redundancy for air traffic control;
- Port facilities have higher adaptive capacity to manage increased frequency and intensity of heatwaves due to significant work procedures to address power failure (including back up power for refrigerated containers) and safety of workers that are already in place; and
- The use of outdoor grassed facilities has higher adaptive capacity in relation to reduced rainfall in winter-spring as the use of such facilities will increase as the climate is more suitable for outdoor activities.

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; and
- As average temperatures increase, there may be more potential to hold events during non-summer months.

4.0 Transitioning from the IVA to adaptation planning

The third task of the AdaptWest project is to prepare the Regional Climate Change Adaptation Plan. The themes derived from the indicators as described in section 3 of this report 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 lead to:

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

4.1 Proposed areas of focus

AdaptWest is using adaptation pathways analysis to prepare the Regional 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 or feature that is valued. For example, provide, protect and manage;
- The valued feature or aspect that the Region is focussed on. For example, public coastal assets; and
- The reason why the Region needs to take action, i.e. in response to a particular climate impact such as sea level rise.

For AdaptWest, 12 key areas of decision making are proposed (refer Table 8).

Appendix D shows how these key areas of decision making relate to the relevant priority indicators from the IVA analysis and associated key features.

**Table 8 AdaptWest key areas of decision making**

Theme	Rationale	Key area of decision making
Vulnerable members of the community	A strong and connected community and amenity and quality of life are valued by the Western Adelaide Region. 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 with mental health issues through to impacts on mobility and the ability to support people who need assistance with core services where flooding occurs.	How do we improve the health, safety and wellbeing of vulnerable members of the community to cope better with extreme events such as more frequent and intense heatwaves and flooding?
Public coastal built assets	Public coastal assets play a vital role in the use and enjoyment of the coastal areas in the Western Adelaide Region. These assets include jetties, boat ramps and Surf Life Saving Clubs, foreshore open space and cycling and walking pathways. The IVA found that climate change will impact public coastal assets as a consequence of flooding caused by the combined effects of sea level rise and storm surge. This will result in periodic flooding and less effective operation of some assets and physical damage to others.	How do we provide, protect and manage public coastal assets as the sea level rises?
Open and green spaces and recreation	Open and green spaces in the Western Adelaide Region are highly valued and play an important role in supporting strong and connected communities and contribute to amenity, quality of life and biodiversity. Street trees and landscaped public realm areas also assist in reducing the urban heat island effect. The IVA found that open and green spaces will be impacted by climate change because of the impact of warmer and drier conditions and climate extremes on vegetated areas and the availability of groundwater or recycled stormwater for irrigation and the impact of similar climate factors on hard infrastructure like playgrounds and outdoor recreational facilities. The effect will vary for green spaces and vegetated areas across the region depending on their access to irrigation.	How do we provide, protect and manage open and green spaces as we experience warmer and drier conditions, more frequent and intense heatwaves and the sea level rises?
Natural landscapes-coastal	The coast is a valued environmental, community and economic asset to the Western Adelaide Region. The IVA found that climate change will impact the condition of natural coastal landscapes, especially beaches and dunes, which will erode as sea levels rise. The impact will vary depending on the presence of backshore vegetated dunes, which will provide some degree of adaptive capacity as beaches recede.	How do we protect and enhance the condition of natural coastal landscapes as the sea level rises?



Theme	Rationale	Key area of decision making
Natural landscape-estuarine	The estuarine landscapes in the Western Adelaide Region, especially mangrove and samphire systems are highly valued. They provide important habitat for listed migratory wading birds and nurseries for recreational and commercial fisheries. The IVA found that climate change will impact the condition of natural estuarine landscapes in the Region, especially mangrove and samphire systems. These will be susceptible to rising sea levels given that the opportunity for this type of vegetation to retreat to higher ground will be limited.	How do we protect and enhance the condition of natural estuarine landscapes as the sea level rises?
Urban living	Much of the Western Adelaide Region is highly urbanised, with the predominant land use being residential. This will increase in coming years as the Region is earmarked for further urban development (the majority of which will be infill), population growth and employment lands. The design of urban areas ranging from individual houses to the public realm will in turn impact the health and wellbeing of people living in the region and values like a strong and connected community and amenity and quality of life. The IVA found that climate change will influence the amenity and liveability of urban areas. Housing across the region will be physically impacted by warmer and drier conditions and dwellings in low lying areas could be impacted by periodic flooding.	How do we create better amenity and liveability in our urban areas as our climate becomes warmer and drier, we experience more frequent and intense heatwaves, rainfall intensity increases and the sea level rises?
Stormwater management infrastructure	The management and use of stormwater is a key value for the Western Adelaide Region as it contributes to the protection of housing and other development from flooding and can be collected and harvested for irrigation thereby contributing to the greenness and amenity of the Region. The IVA found that stormwater management infrastructure will be impacted in a variety of ways: pipes and drains may be insufficient for changes to rainfall intensity and flooding; stormwater retention wetlands will experience changed water regimes; and the operation of stormwater outlets and pump stations will be periodically affected by the combined effects of sea level rise and storm surge. Maintaining stormwater infrastructure is essential because it can also offer adaptive capacity for other important features of the Region such as open vegetated space.	How do we design, construct and maintain stormwater management infrastructure as annual rainfall declines, rainfall intensity increases and the sea level rises?



Theme	Rationale	Key area of decision making
Community connectedness	A strong and connected community is highly valued by the Western Adelaide Region. The IVA found that climate change will present challenges to building strong and connected communities. More frequent and intense heatwaves will reduce the conditions conducive to activities amongst community groups and clubs during summer. Heatwaves and flooding will also have a detrimental effect on community infrastructure that supports community connection such as parks, walking and cycling paths, recreation facilities and community buildings. The impact will vary across the Region depending on the amount of community infrastructure located in coastal areas.	How do we build a strong and connected community as we experience more frequent and intense heatwaves and flooding?
Business and industry	Business and industry in the Western Adelaide Region underpins the productivity and economy not only of the Region but more broadly the State. Business and industry in the Region provides employment opportunities which contributes to people's quality of life and the well-being of the community. The IVA found that climate change will impact on businesses and industries in the region because the combined effects of sea level rise, storm surge and high amounts of stormwater runoff can lead to significant inundation of land, transport routes and commercial and industrial buildings. This has implications for current business and industrial areas as well as those planned for potential future industrial development surrounding the Port River Estuary.	How do we enable business and industry to prosper as rainfall intensity increases and the sea level rises?
Transport and essential services	The Western Adelaide Region contains transport and essential services that are vital for the local and State economy. The IVA found that more frequent and intense heatwaves will impact transport services, such as trains and buses, by impacting infrastructure and scheduling and causing disruption due to power outages resulting in traffic light dysfunction. Increased rainfall intensity, sea level rise and storm surge can also combine to reduce the effective operation of transport infrastructure (road and rail) and energy distribution networks.	How do we minimise disruption to transport and essential services as we experience more frequent and intense heatwaves, increased rainfall intensity and sea level rise?



Theme	Rationale	Key area of decision making
Inland waters	Inland waters such as the River Torrens, West Lakes and the various constructed wetlands are highly valued by the Western Region for their contribution to strong and connected communities, amenity and quality of life and water quality. The IVA found that climate change will impact inland waters by increasing the risk of poor water quality, especially due to algal (cyanobacterial) blooms. Algal blooms will be stimulated by warmer conditions and input of nutrients from hard surfaces as a consequence of more intense rainfall events, particularly those following dry spells when 'first flush' flows may have higher pollutant loads. West Lakes faces the additional challenge of sea level rise, with increasing sea levels impacting the rate and amount of flushing that can occur and hence the ability to maintain its amenity and function.	How do we maintain the amenity and function of inland waters as we experience more frequent and intense heatwaves, rainfall intensity increases and the sea level rises?
Estuarine waters	Estuarine waters in the Western Adelaide Region such as the Port River Estuary and Barker Inlet are highly valued for their contribution to coastal environment and water quality, to amenity and quality of life, to biodiversity (supporting mangroves and as fish nursery areas) and to tourism. The IVA found that climate change will impact estuarine waters by increasing the risk of poor water quality, especially due to algal (cyanobacterial) blooms, which will be encouraged by warmer conditions and input of nutrients from hard surfaces as a consequence of more intense rainfall events. Estuarine waters in the Port River have some adaptive capacity due to nearby constructed wetlands which can capture stormwater runoff, however, sea level rise may ultimately diminish their effectiveness.	How do we maintain the amenity and function of estuarine waters as we experience more frequent and intense heatwaves, rainfall intensity increases and the sea level rises?

5.0 Next steps

The next stage of the AdaptWest project 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. A qualitative assessment will be undertaken of the cost benefit 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 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.



6.0 References

AdaptWest (2014) *Assets, Infrastructure and Economy Research Paper*

AdaptWest (2014) *Coastal Management Research Paper*

AdaptWest (2014) *Environment and Open Space Research Paper*

AdaptWest (2014) *Social and Community Resilience and Health Research Paper*

AdaptWest (2014) *Urban Planning and Development Research Paper*

AdaptWest (2014) *Identifying climate variables for use by the Integrated Vulnerability Assessment for the Western Adelaide Region*

Coastal Flooding Visualisation Tool, Department of the Environment <http://www.vistool.com.au/>

Government of South Australia (2012) *Prospering in a Changing Climate: A Climate Change Adaptation Framework for South Australia*

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

Tonkin (May 2015) *Coastal and Inundation Modelling – Phase 1 Report*

SKM (2013) *Western Adelaide Region Climate Change Adaptation Plan – Stage 1*



Appendix A

Complete list of indicators and relationship to AdaptWest values

Indicators	AdaptWest Values							
	Coastal Environment	Biodiversity	Coastal and riverine water quality	Management and use of stormwater	Infrastructure and essential services	Regional productivity and economic contribution to the State	A strong and connected community	Amenity and quality of Life
Ability of WSUD features (including constructed wetlands) to function effectively			✓	✓				
CALD members of the community							✓	
Community and civic events and celebrations							✓	
Condition and extent of beaches and dunes	✓	✓	✓					
Condition and extent of native vegetation cover by vegetation type	✓	✓	✓					
Condition and extent of native vegetation cover by vegetation type (Native wetland and riparian plant communities)		✓	✓					
Condition of benthic habitat (e.g. sea grass, pests)	✓	✓	✓					
Condition of built cultural heritage (e.g. heritage buildings, bridges, monuments, public art)								✓
Condition of natural cultural heritage (e.g. scar trees, heritage vineyard, springs, rivers, burial grounds)		✓						✓
Contribution to Gross Regional Product (Western Adelaide Region)						✓		
Demand for emergency services								✓
Effective functioning of active recreation and sporting sites (indoor and outdoor)	✓				✓			✓
Effective functioning of built assets and contents (houses)	✓			✓	✓			
Effective functioning of cycling and walking infrastructure (e.g. footpaths etc.)	✓				✓			✓
Effective functioning of open space (predominantly green space)	✓				✓			✓



Indicators	AdaptWest Values							
	Coastal Environment	Biodiversity	Coastal and riverine water quality	Management and use of stormwater	Infrastructure and essential services	Regional productivity and economic contribution to the State	A strong and connected community	Amenity and quality of Life
Effective functioning of public realm (constructed assets, fountains etc.)	✓				✓			✓
Effective functioning of public realm (green assets - trees and landscaping)	✓				✓			✓
Effective functioning of recreation facilities (e.g. Surf Life Savings Clubs, playgrounds)	✓				✓			✓
Effective functioning of stormwater management infrastructure (drains, gutters, pipes)				✓	✓			
Effective functioning of tourist facilities (e.g. Henley Square, Port Wharf markets, Adelaide Shores etc.)						✓		✓
Effective operation of airport				✓	✓	✓		
Effective operation of built assets and contents (business and industry)	✓			✓		✓		
Effective operation of coastal assets	✓				✓			
Effective operation of defence industries						✓		
Effective operation of electricity supply					✓	✓		
Effective operation of port facilities	✓				✓	✓		
Effective operation of potable water supply (e.g. pipes and pumps) and treatment plants					✓			
Effective operation of public buildings (incl. Schools, libraries, hospitals)					✓		✓	
Effective operation of rail network					✓			
Effective operation of road network				✓	✓			
Effective operation of telecommunications infrastructure					✓	✓		
Effective operation of wastewater treatment systems (e.g. pipes, plant, distribution etc.)					✓			
Employment by key sectors							✓	



Indicators	AdaptWest Values							
	Coastal Environment	Biodiversity	Coastal and riverine water quality	Management and use of stormwater	Infrastructure and essential services	Regional productivity and economic contribution to the State	A strong and connected community	Amenity and quality of Life
Groundwater quantity and quality (for use by industry)						✓		
Incidence of anti-social behaviour								✓
Incidence of social behaviour-Neighbourly interactions								✓
Interruption to public transport services					✓		✓	
Level of support from family, friends and neighbours							✓	
Members of the community living in public housing							✓	
Members of the community living with mental health problems							✓	✓
Members of the community under financial stress							✓	
Members of the community who require assistance for core activities							✓	
Members of the community with poor self-assessed health							✓	✓
Older members of the community (aged >75)							✓	
Participation in organised sport, church or community group in local area							✓	
Potential for future industrial development						✓		
Quality of water – coastal/estuaries	✓		✓					✓
Quality of water - inland waters		✓	✓					
Quantity of stormwater generated	✓		✓	✓				
Rates of volunteerism in organised support groups (e.g. Surf Life Savings Clubs, Meals on Wheels, service clubs, SES)							✓	
Younger members of the community (e.g. <12)							✓	



Appendix B

Complete Integrated Vulnerability Assessment

Grouping	Subgroup	Coastal Environment	Biodiversity	Coastal and Riverine WQ	Stormwater	Infrastructure and Essential Services	Productivity and economy	Community	Attenity and Quality of Life	Indicator /s	Feature to score	Exposure (Climate Variable)	Exposure Score	Sensitivity to Climate Variable	Sensitivity Score	Comment	Potential Impact	Comment on Adaptive Capacity from Research Papers	Adaptive Capacity Score	Adaptive Capacity Workshop Comment	Vulnerability Score
Economic and Infrastructure	Water / Engineering			Yes	Yes					Ability of WSUD features (including constructed wetlands) to function effectively	WSUD wetlands, swales and vegetated treatments	Heat wave increase frequency and intensity	5	3 - Moderate	3	Vegetation associated with WSUD may be less sensitive to hot days as potentially greater soil moisture or surface water present	8	Species selection for wetland plantings Maintenance plans Appropriate design	4	Design of some WSUD features does have inbuilt ability to irrigate. AC will depend on selection of plant species. Plant selection may depend on what a developer chooses.	14
Economic and Infrastructure	Water / Engineering			Yes	Yes					Ability of WSUD features (including constructed wetlands) to function effectively	MAR recharge and storage	Rainfall reduction: winter-spring	5	5 - High	5	Less water available for recharge	10	Other water quality treatments required	6	AC depends on what effective functioning means. Several schemes are already producing more water than the demand	14
Economic and Infrastructure	Water / Engineering			Yes	Yes					Ability of WSUD features (including constructed wetlands) to function effectively	WSUD wetlands, swales and vegetated treatments	Rainfall reduction: winter-spring	5	5 - High	5	Change to water regime of WSUD sites and water levels, and vegetation demand for water, increased maintenance costs	10	Species selection for wetland plantings Maintenance and irrigation plans Appropriate design	8	Adaptive capacity may vary depending on size of system e.g. Street scale tree pit versus large scale open wetland.	12
Economic and Infrastructure	Water / Engineering			Yes	Yes					Ability of WSUD features (including constructed wetlands) to function effectively	WSUD wetlands, swales and vegetated treatments	Temperature increase	5	4 - Moderate to High	4	Potential impact on water regime of WSUD sites and water levels, and vegetation demand for water, increased maintenance costs	9	Species selection for wetland plantings Maintenance and irrigation plans Appropriate design	7		12
Economic and Infrastructure	Water / Engineering			Yes	Yes					Ability of WSUD features (including constructed wetlands) to function effectively	WSUD wetlands, swales and vegetated treatments	Rainfall intensity increase	5	5 - High	5	Water treatment not effective during high flows,	10	Species selection for wetland plantings Maintenance and irrigation plans Appropriate design	9	Most systems are designed to overflow. Scour is the only potential risk	11
Social	Vulnerable communities							Yes		CALD members of the community	CALD members of the community	Sea level rise	5	4 - 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.	9	Public health plans	2	No different to other members of the community re SLR	17
Social	Vulnerable communities							Yes		CALD members of the community	CALD members of the community	Heat wave increase frequency and intensity	5	4 - 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	9	SA Health heat wave fact sheets translated into numerous languages Community services support Public health plans	5	Ethic radio, SBS, media, ABC 891, local press, websites, SMS, Ethnic press. Cultural networking groups eg Greek and Italian groups. Some cultural groups have excellent knowledge of how to adapt to climate impacts that we can learn from. Australia refugee Association, Thebarton Senior College. work with cultural community groups to disseminate information eg re food safety. More recent arrivals and cultural groups with smaller numbers will be more vulnerable . Multicultural SA	14
Social	Vulnerable communities							Yes		CALD members of the community	CALD members of the community	Rainfall intensity increase	5	4 - 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	9	Public health plans Stormwater management plans	5	A lack of emergency refuge centres. Emergency management planning, stormwater management plans, sandbagging and Councils provide sandbags are provided where know flooding occurs, Flood Safe program, management infrastructure. Vegetable gardening is important cultural contribution and will be impacted. May be renting and have less control over maintenance and protection of homes. Risk re lack of knowledge re our beaches, rips, swimming between the flags etc and drownings as a result	14
Social	Community events and activities							Yes		Community and civic events and celebrations	Events and celebrations	Heat wave increase frequency and intensity	5	5 - High	5	Events may have to be rescheduled or cancelled if coincide with heat waves	10		6	Council heat policy in place cancellation and/or reschedule events, provision of shade timing of event, length of event, security, water provided, first aid officers on hand, food safety and waste disposal policies/procedures. CALD food preparation can differ. Very limited ability to adapt further and events suffer. Many can not be changed in terms of date. debate over scoring-some think AC is higher eg 7	14
Social	Community events and activities							Yes		Community and civic events and celebrations	Events and celebrations	Rainfall intensity increase	5	5 - High	5	Events may have to be rescheduled or cancelled if coincide with heavy rainfall	10		6	Cancellation and rescheduling, move event indoors. More likely to cancel if rains, but can continue in relation to heatwave	14
Social	Community events and activities							Yes		Community and civic events and celebrations	Events and celebrations	Sea level rise	5	5 - High	5	Inundation would mean events may have to be rescheduled or cancelled	10		6	slow burn issue. Semaphore foreshore a key event space, can reschedule or relocate for individual event. Coastal events (eg kite flying or life saving) may not be as flexible	14
Social	Community events and activities							Yes		Community and civic events and celebrations	Events and celebrations	Temperature increase	5	3 - Moderate	3	Possible opportunity for more events as warmer weather in winter	8		9	Potential opportunity for more events in non-summer months	9
Environment	Coast, marine and aquatic	Yes	Yes	Yes						Condition and extent of beaches and dunes	Beaches without backshore vegetated dunes	Sea level rise	5	5 - High	5	Will lead to erosion of beaches and loss of dunes,	10	Beach sand replenishment	1	Hard infrastructure almost directly behind sand dunes	19
Environment	Coast, marine and aquatic	Yes	Yes	Yes						Condition and extent of beaches and dunes	Beaches with backshore vegetated dunes south of Bower Road	Sea level rise	5	5 - High	5	Will lead to erosion of beaches and loss of dunes,	10	Dune buffers and protection Revegetation of backshore dunes Beach sand replenishment	2	Limited natural ability to migrate Sand pumping / transfer Revegetation provides ability to store sand within dunes	18

Grouping	Subgroup	Coastal Environment	Biodiversity	Coastal and Riverine WQ	Stormwater	Infrastructure and Essential Services	Productivity and economy	Community	Amenity and Quality of Life	Indicator /s	Feature to score	Exposure (Climate Variable)	Exposure Score	Sensitivity to Climate Variable	Sensitivity Score	Comment	Potential Impact	Comment on Adaptive Capacity from Research Papers	Adaptive Capacity Score	Adaptive Capacity Workshop Comment	Vulnerability Score
Environment	Coast, marine and aquatic	Yes	Yes	Yes						Condition and extent of beaches and dunes	Beaches with backshore vegetated dunes north of Bower Road	Sea level rise	5	5 - High	5	Will lead to erosion of beaches and loss of dunes.	10	Dune buffers and protection Revegetation of backshore dunes Beach sand replenishment	6	Limited natural ability to migrate Sand pumping / transfer Revegetation provides ability to store sand within dunes Some buffers increasing in northern beaches north of Bower Road	14
Environment	Biodiversity		Yes							Condition and extent of native vegetation cover by vegetation type	Coastal shrubland and remnant dune vegetation (including Spinifex grassland)	Sea level rise	5	5 - High	5	Coastal shrubland will be impacted by sea level rise through loss of habitat such as dunes.	10	Management Plans for mangrove areas eg Mangrove Cove, PAE Biodiversity Management Plan, Our Patch sites, Adelaide Dolphin Sanctuary	2	Urban development restricts the movement of dunes inland. Lost a lot of beach near Semaphore last year. Out front of Largs Bay has become wider. Dunes that are well stabilised are not necessarily gong to blow inland. Narrower range of vegetation is impacting succession rates of vegetation.	18
Environment	Biodiversity	Yes	Yes	Yes						Condition and extent of native vegetation cover by vegetation type	Mangroves	Sea level rise	5	5 - High	5	Highly sensitive to sea level rise. Although it can tolerate daily inundation it cannot tolerate permanent deep inundation.	10	Management Plans including PAE Biodiversity Management Plan and Mutton Cove Management Plan, natural physiological adaptation through water storage in stems	2	In Mangrove Cove, mangroves are moving into samphire flat areas. Local observations of ability for mangroves to re-establish. Areas such as Torrens Island, they will be able too move further inland. Mangroves typically grow in areas that have been impacted by industrial/urban development.	18
Environment	Biodiversity		Yes							Condition and extent of native vegetation cover by vegetation type	Samphire shrubland	Sea level rise	5	5 - High	5	Unable to tolerate permanent inundation for extended periods.	10	Management Plans including PAE Biodiversity Management Plan and Mutton Cove Management Plan, natural physiological adaptation include aerenchyma	2	Ability to migrate inland is low.	18
Environment	Biodiversity		Yes							Condition and extent of native vegetation cover by vegetation type	Eucalyptus woodland	Rainfall reduction: winter-spring	5	4 - Moderate to High	4	Eucalypt woodlands are more typical of moderate rainfall areas in the state (e.g. 250 to 600 mm). Woodlands are less sensitive to temperature than rainfall.	9	Management Plans for mangrove areas eg Mangrove Cove, PAE Biodiversity Management Plan, Our Patch sites, Adelaide Dolphin Sanctuary	4	Area has been fenced off which has protected the soil surface. There is greater habitat value. Regeneration from existing seedbank. Because it is well established it has higher adaptive capacity. There is a potential impact from pest species such as fungi, insect species, foxes. Small size means it has lower adaptive capacity.	15
Environment	Biodiversity	Yes	Yes	Yes						Condition and extent of native vegetation cover by vegetation type	Coastal shrubland and remnant dune vegetation (including Spinifex grassland)	Heat wave increase frequency and intensity	5	3 - Moderate	3	Vegetation type also occurs in areas of the State with higher temperatures and lower rainfall. Suggest that its sensitive to temperature and rainfall is low--moderate.	8	Natural adaptation includes change in species composition and distribution, management plans, community involvement (our patch and bushcare)	4	Increasing drought periods may make vegetation more susceptible to dieback. Reducing resilience. Large number of plantings after drought at Barker Inlet died off because no follow up rainfall. Local knowledge and volunteers is important to know how, where and when to plant. Some Councils have already adapted their planting regimes by deep stemmed planting and different watering regime e.g. At least one watering during summer. Prolonged periods of hot weather can have a greater impact on coastal areas through greater usage. Human impact can be important. In natural setting adaptive capacity would be moderate to high, but given human impacts adaptive capacity scores is low-moderate.	14
Environment	Biodiversity		Yes							Condition and extent of native vegetation cover by vegetation type	Eucalyptus woodland	Heat wave increase frequency and intensity	5	3 - Moderate	3	Eucalypt woodlands are more typical of moderate rainfall areas in the state (e.g. 250 to 600 mm). Woodlands are less sensitive to temperature than rainfall.	8	WSUD in coastal areas, revegetation, dune management plans, natural adaptation includes change in species composition and distribution, management plans, community involvement (our patch and bushcare)	4	Area has been fenced off which has protected the soil surface. There is greater habitat value. Regeneration from existing seedbank. Because it is well established it has higher adaptive capacity. There is a potential impact from pest species such as fungi, insect species, foxes. Small size means it has lower adaptive capacity.	14
Environment	Biodiversity	Yes	Yes	Yes						Condition and extent of native vegetation cover by vegetation type	Coastal shrubland and remnant dune vegetation (including Spinifex grassland)	Rainfall reduction: winter-spring	5	3 - Moderate	3	Vegetation type also occurs in areas of the State with higher temperatures and lower rainfall. Suggest that its sensitive to temperature and rainfall is low--moderate.	8	Management Plans for mangrove areas eg Mangrove Cove, PAE Biodiversity Management Plan, Our Patch sites, Adelaide Dolphin Sanctuary	4	Increasing drought periods may make vegetation more susceptible to dieback. Reducing resilience. Large number of plantings after drought at Barker Inlet died off because no follow up rainfall. Local knowledge and volunteers is important to know how, where and when to plant. Some Councils have already adapted their planting regimes by deep stemmed planting and different watering regime e.g. At least one watering during summer. Prolonged periods of hot weather can have a greater impact on coastal areas through greater usage. Human impact can be important. In natural setting adaptive capacity would be moderate to high, but given human impacts adaptive capacity scores is low-moderate.	14

Grouping	Subgroup	Coastal Environment	Biodiversity	Coastal and Riverine WQ	Stormwater	Infrastructure and Essential Services	Productivity and economy	Community	Attenity and Quality of Life	Indicator /s	Feature to score	Exposure (Climate Variable)	Exposure Score	Sensitivity to Climate Variable	Sensitivity Score	Comment	Potential Impact	Comment on Adaptive Capacity from Research Papers	Adaptive Capacity Score	Adaptive Capacity Workshop Comment	Vulnerability Score
Environment	Biodiversity	Yes	Yes	Yes						Condition and extent of native vegetation cover by vegetation type	Coastal shrubland and remnant dune vegetation (including Spinifex grassland)	Rainfall intensity increase	5	3 - Moderate	3	Localised impacts only from increased rainfall intensity. Erosive impacts unlikely as no major discharges occur through areas of coastal shrubland and remnant vegetation.	8	Natural landward migration (limited due to hard structural barriers), community involvement (our patch and bushcare), management plans	5	Increasing drought periods may make vegetation more susceptible to dieback. Reducing resilience. Large number of plantings after drought at Barker Inlet died off because no follow up rainfall. Local knowledge and volunteers is important to know how, where and when to plant. Some Councils have already adapted their planting regimes by deep stemmed planting and different watering regime e.g. At least one watering during summer. Prolonged periods of hot weather can have a greater impact on coastal areas through greater usage. Human impact can be important. In natural setting adaptive capacity would be moderate to high, but given human impacts adaptive capacity scores is low-moderate.	13
Environment	Biodiversity	Yes	Yes	Yes						Condition and extent of native vegetation cover by vegetation type	Coastal shrubland and remnant dune vegetation (including Spinifex grassland)	Temperature increase	5	2 - Low to Moderate	2	Vegetation type also occurs in areas of the State with higher temperatures and lower rainfall. Suggest that its sensitive to temperature and rainfall is low--moderate.(AC Species composition may change)	7	Management Plans including PAE Biodiversity Management Plan and Mutton Cove Management Plan, natural physiological adaptation through water storage in stems	4	Increasing drought periods may make vegetation more susceptible to dieback. Reducing resilience. Large number of plantings after drought at Barker Inlet died off because no follow up rainfall. Local knowledge and volunteers is important to know how, where and when to plant. Some Councils have already adapted their planting regimes by deep stemmed planting and different watering regime e.g. At least one watering during summer. Prolonged periods of hot weather can have a greater impact on coastal areas through greater usage. Human impact can be important. In natural setting adaptive capacity would be moderate to high, but given human impacts adaptive capacity scores is low-moderate.	13
Environment	Biodiversity		Yes							Condition and extent of native vegetation cover by vegetation type	Eucalyptus woodland	Temperature increase	5	2 - Low to Moderate	2	Eucalypt woodlands are more typical of moderate rainfall areas in the state (e.g. 250 to 600 mm). Woodlands are less sensitive to temperature than rainfall.	7	Management Plans including PAE Biodiversity Management Plan and Mutton Cove Management Plan, natural physiological adaptation through water storage in stems	4	Area has been fenced off which has protected the soil surface. There is greater habitat value. Regeneration from existing seedbank. Because it is well established it has higher adaptive capacity. There is a potential impact from pest species such as fungi, insect species, foxes. Small size means it has lower adaptive capacity.	13
Environment	Biodiversity	Yes	Yes	Yes						Condition and extent of native vegetation cover by vegetation type	Mangroves	Rainfall intensity increase	5	4 - Moderate to High	4	Localised impacts only from increased rainfall intensity. Erosive impacts may occur from localised stormwater discharges as well as additional siltation of the root zone.	9	Revegetation, dune management plans, natural adaptation includes change in species composition and distribution	8		11
Environment	Biodiversity	Yes	Yes	Yes						Condition and extent of native vegetation cover by vegetation type	Coastal shrubland and remnant dune vegetation (including Spinifex grassland)	Rainfall reduction: summer-autumn	2	3 - Moderate	3	Vegetation type also occurs in areas of the State with higher temperatures and lower rainfall. Suggest that its sensitive to temperature and rainfall is low--moderate.	5	Folland Park Management Plan, PAE Biodiversity Management Plan, Trees for Life involvement, Bushcare site	4	Increasing drought periods may make vegetation more susceptible to dieback. Reducing resilience. Large number of plantings after drought at Barker Inlet died off because no follow up rainfall. Local knowledge and volunteers is important to know how, where and when to plant. Some Councils have already adapted their planting regimes by deep stemmed planting and different watering regime e.g. At least one watering during summer. Prolonged periods of hot weather can have a greater impact on coastal areas through greater usage. Human impact can be important. In natural setting adaptive capacity would be moderate to high, but given human impacts adaptive capacity scores is low-moderate.	11
Environment	Biodiversity		Yes							Condition and extent of native vegetation cover by vegetation type	Eucalyptus woodland	Rainfall reduction: summer-autumn	2	3 - Moderate	3	Eucalypt woodlands are more typical of moderate rainfall areas in the state (e.g. 250 to 600 mm). Woodlands are less sensitive to temperature than rainfall.	5	Folland Park Management Plan, PAE Biodiversity Management Plan, Trees for Life involvement, Bushcare site	4	Area has been fenced off which has protected the soil surface. There is greater habitat value. Regeneration from existing seedbank. Because it is well established it has higher adaptive capacity. There is a potential impact from pest species such as fungi, insect species, foxes. Small size means it has lower adaptive capacity.	11
Environment	Biodiversity	Yes	Yes	Yes						Condition and extent of native vegetation cover by vegetation type	Mangroves	Heat wave increase frequency and intensity	5	2 - Low to Moderate	2	Vegetation type also occurs in areas of the State with higher temperatures and lower rainfall. Suggest that its sensitive to temperature and rainfall is low--moderate.	7	Revegetation, dune management plans, natural adaptation includes change in species composition and distribution, community involvement (our patch and bushcare)	8	Already growing in areas of the State with lower rainfall and higher temperatures.	9
Environment	Biodiversity	Yes	Yes	Yes						Condition and extent of native vegetation cover by vegetation type	Samphire shrubland	Heat wave increase frequency and intensity	5	2 - Low to Moderate	2	Vegetation type also occurs in areas of the State with higher temperatures and lower rainfall. Suggest that its sensitive to temperature and rainfall is low--moderate.	7	Revegetation, dune management plans, natural adaptation includes change in species composition and distribution, community involvement (our patch and bushcare)	8		9

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Environment	Biodiversity	Yes	Yes	Yes						Condition and extent of native vegetation cover by vegetation type	Samphire shrubland	Rainfall intensity increase	5	2 - Low to Moderate	2	Localised impacts only from increased rainfall intensity. Erosive impacts unlikely as no major discharges occur through areas of samphire shrubland.	7	Folland Park Management Plan, PAE Biodiversity Management Plan, Trees for Life involvement, Bushcare site	8		9
Environment	Biodiversity	Yes	Yes	Yes						Condition and extent of native vegetation cover by vegetation type	Mangroves	Rainfall reduction: winter-spring	5	2 - Low to Moderate	2	Vegetation type also occurs in areas of the State with higher temperatures and lower rainfall. Suggest that its sensitive to temperature and rainfall is low-moderate.	7	Management Plans for mangrove areas eg Mangrove Cove, PAE Biodiversity Management Plan, Our Patch sites, Adelaide Dolphin Sanctuary	8		9
Environment	Biodiversity	Yes	Yes	Yes						Condition and extent of native vegetation cover by vegetation type	Samphire shrubland	Rainfall reduction: winter-spring	5	2 - Low to Moderate	2	Vegetation type also occurs in areas of the State with higher temperatures and lower rainfall. Suggest that its sensitive to temperature and rainfall is low-moderate.	7	Management Plans for mangrove areas eg Mangrove Cove, PAE Biodiversity Management Plan, Our Patch sites, Adelaide Dolphin Sanctuary Natural adaptation through landward migration may be limited due to rate of change of sea level and hard structural barriers	8		9
Environment	Biodiversity	Yes	Yes	Yes						Condition and extent of native vegetation cover by vegetation type	Mangroves	Temperature increase	5	2 - Low to Moderate	2	Vegetation type also occurs in areas of the State with higher temperatures and lower rainfall. Suggest that its sensitive to temperature and rainfall is low-moderate.	7	Management Plans including PAE Biodiversity Management Plan and Mutton Cove Management Plan, natural adaptation includes landward retreat, may be limited due to altered soil type, hard barriers and current landuse	8		9
Environment	Biodiversity	Yes	Yes	Yes						Condition and extent of native vegetation cover by vegetation type	Samphire shrubland	Temperature increase	5	1 - Low	1	Vegetation type also occurs in areas of the State with higher temperatures and lower rainfall. Suggest that its sensitive to temperature and rainfall is low-moderate.	6	Management Plans including PAE Biodiversity Management Plan and Mutton Cove Management Plan, natural physiological adaptation through water storage in stems	8		8
Environment	Biodiversity	Yes	Yes	Yes						Condition and extent of native vegetation cover by vegetation type	Mangroves	Rainfall reduction: summer-autumn	2	2 - Low to Moderate	2	Vegetation type also occurs in areas of the State with higher temperatures and lower rainfall. Suggest that its sensitive to temperature and rainfall is low-moderate.	4	Folland Park Management Plan, PAE Biodiversity Management Plan, Trees for Life involvement, Bushcare site	8		6
Environment	Biodiversity	Yes	Yes	Yes						Condition and extent of native vegetation cover by vegetation type	Samphire shrubland	Rainfall reduction: summer-autumn	2	2 - Low to Moderate	2	Vegetation type also occurs in areas of the State with higher temperatures and lower rainfall. Suggest that its sensitive to temperature and rainfall is low-moderate.	4	Management Plans for mangrove areas eg Mangrove Cove, PAE Biodiversity Management Plan, Our Patch sites, Adelaide Dolphin Sanctuary	8		6
Environment	Biodiversity		Yes	Yes						Condition and extent of native vegetation cover by vegetation type (Native wetland and riparian plant communities)	Condition of wetland plants	Rainfall reduction: winter-spring	5	5 - High	5	Wetland plant communities are influenced by the water regime which is directly influenced by rainfall in the region or run-off generated in upstream catchments. Some species are temperature sensitive but this is less important than water regime. Also impact on recharge of groundwater.	10	Wetland management plans, irrigation plans, water availability from MAR at some wetlands	5	Constructed wetlands are micro-managed and so will assist other wetlands in the region. Wetland plants will find a way to distribute to wetlands in the region. Species mix will change in response to water regime.	15
Environment	Biodiversity		Yes	Yes						Condition and extent of native vegetation cover by vegetation type (Native wetland and riparian plant communities)	Condition of wetland plants	Heat wave increase frequency and intensity	5	3 - Moderate	3	Wetland plant communities are influenced by the water regime which is directly influenced by rainfall in the region or run-off generated in upstream catchments. Some species are temperature sensitive but this is less important than water regime.	8	Wetland management plans, irrigation plans, water availability from MAR at some wetlands	5	Constructed wetlands are micro-managed and so will assist other wetlands in the region. Wetland plants will find a way to distribute to wetlands in the region. Species mix will change in response to water regime.	13
Environment	Biodiversity		Yes	Yes						Condition and extent of native vegetation cover by vegetation type (Native wetland and riparian plant communities)	Condition of wetland plants	Rainfall intensity increase	5	3 - Moderate	3	Wetland plant communities are influenced by the water regime which is directly influenced by rainfall in the region or run-off generated in upstream catchments. Some species are temperature sensitive but this is less important than water regime.	8	Wetland management plans, irrigation plans, water availability from MAR at some wetlands	5	Constructed wetlands are micro-managed and so will assist other wetlands in the region. Wetland plants will find a way to distribute to wetlands in the region. Species mix will change in response to water regime.	13
Environment	Biodiversity		Yes	Yes						Condition and extent of native vegetation cover by vegetation type (Native wetland and riparian plant communities)	Condition of wetland plants	Temperature increase: summer-autumn	4	2 - Low to Moderate	2	Wetland plant communities are influenced by the water regime which is directly influenced by rainfall in the region or run-off generated in upstream catchments. Some species are temperature sensitive but this is less important than water regime.	6	Wetland management plans, irrigation plans, water availability from MAR at some wetlands	5	Constructed wetlands are micro-managed and so will assist other wetlands in the region. Wetland plants will find a way to distribute to wetlands in the region. Species mix will change in response to water regime.	11
Environment	Biodiversity		Yes	Yes						Condition and extent of native vegetation cover by vegetation type (Native wetland and riparian plant communities)	Condition of wetland plants	Rainfall reduction: summer-autumn	2	3 - Moderate	3	Wetland plant communities are influenced by the water regime which is directly influenced by rainfall in the region or run-off generated in upstream catchments. Some species are temperature sensitive but this is less important than water regime.	5	Wetland management plans, irrigation plans, water availability from MAR at some wetlands	5	Constructed wetlands are micro-managed and so will assist other wetlands in the region. Wetland plants will find a way to distribute to wetlands in the region. Species mix will change in response to water regime.	10
Environment	Coast, marine and aquatic	Yes	Yes	Yes						Condition of benthic habitat (e.g. sea grass, pests)	Seagrass	Sea surface temperature increase	5	4 - Moderate to High	4	Sea grass chloroplasts are sensitive to water temperature. Large dieback observed in Spencer Gulf in 2003 following extreme surface heat event	9	Adelaide Coastal Waters Water Quality Improvement Plan	1	WQIPs potential	18

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Environment	Coast, marine and aquatic	Yes	Yes	Yes						Condition of benthic habitat (e.g. sea grass, pests)	Seagrass	Sea level rise	5	4 - Moderate to High	4	Depth of the euphotic zone will be influenced by rising sea levels, which is likely to influence where sea grass grows in the Gulf.	9	Adelaide Coastal Waters Water Quality Improvement Plan	2	Some natural adaptive capacity may result in changes in species composition, changes seen in other locations around Australia	17
Environment	Coast, marine and aquatic	Yes	Yes	Yes						Condition of benthic habitat (e.g. sea grass, pests)	Seagrass	Rainfall intensity increase	5	3 - Moderate	3	Resulting sediment and nutrient plumes into coastal waters may decrease light availability for photosynthesis	8	WSUD, stormwater defentions and treatment to reduce pollutant loads in discharge,	3	Stormwater management plans, stormwater treatment infrastructure (WSUD, wetlands, etc), catchment management upstream, infrastructure design decisions re capacity and sizing, planning policy (area of impervious, on-site capture and storage), WQIP, Waterproofing the West	15
Environment	Coast, marine and aquatic	Yes	Yes	Yes						Condition of benthic habitat (e.g. sea grass, pests)	Seagrass	Ocean acidity increase	3	1 - Low	1	No reports of changes to seagrass growth relating to increase in CO2 in Australia or elsewhere. Ocean acidification may be buffered by photosynthetic activity. Productivity may actually increase with increased CO2 concentrations although consequential changes in daily pH levels may impact species living in seagrass	4	Adelaide Coastal Waters Water Quality Improvement Plan	1	Unknown impacts of acidity on marine environment	13
Economic and Infrastructure	Buildings and Infrastructure								Yes	Condition of built cultural heritage (e.g. heritage buildings, bridges, monuments, public art)	Condition of built cultural heritage	Rainfall intensity increase	5	4 - 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	9	SA Heritage Register listing, grants and incentives for conservation works, heritage policy	2	Stormwater management plans in some areas protect assets at current inundation levels but not sufficient to cope with 2070 conditions, heritage not priority of SMPs Poor adaptive capacity as no funding and nothing in place at the moment	17
Economic and Infrastructure	Buildings and Infrastructure								Yes	Condition of built cultural heritage (e.g. heritage buildings, bridges, monuments, public art)	Condition of built cultural heritage	Sea level rise	5	4 - Moderate to High	4	Older buildings more sensitive to inundation. Contents may also be of value and sensitive.	9	SA Heritage Register listing, grants and incentives for conservation works	2	Stormwater management plans in some areas protect assets at current inundation levels but not sufficient to cope with 2070 conditions, heritage not priority of SMPs Poor adaptive capacity as no funding and nothing in place at the moment	17
Economic and Infrastructure	Buildings and Infrastructure								Yes	Condition of built cultural heritage (e.g. heritage buildings, bridges, monuments, public art)	Condition of built cultural heritage	Rainfall reduction: winter-spring	5	3 - Moderate	3	Possible impacts from soil heavage through reduced soil moisture levels. Older buildings more sensitive.	8	SA Heritage Register listing, grants and incentives for conservation works	2	Stormwater management plans in some areas protect assets at current inundation levels but not sufficient to cope with 2070 conditions, heritage not priority of SMPs Poor adaptive capacity as no funding and nothing in place at the moment	16
Social	Community events and activities		Yes						Yes	Condition of natural cultural heritage (e.g. scar trees, heritage vineyard, springs, rivers, burial grounds)	Condition of natural cultural heritage	Sea level rise	5	4 - Moderate to High	4	Cultural sites are assumed to be sensitive to inundation where this impacts on the condition of plant and animal communities and water bodies at a cultural heritage site	9	Protection under Aboriginal Heritage Act	2	Current maintenance is not designed or resourced to cope with future climate	17
Social	Community events and activities		Yes						Yes	Condition of natural cultural heritage (e.g. scar trees, heritage vineyard, springs, rivers, burial grounds)	Condition of natural cultural heritage	Rainfall reduction: winter-spring	5	3 - Moderate	3	Cultural sites are assumed to be sensitive to reducing rainfall where this impacts on the condition of plant and animal communities and water bodies at a cultural heritage site	8	Protection under Aboriginal Heritage Act	3	Current maintenance is not designed or resourced to cope with future climate, Some irrigation could be applied, but not currently in place	15
Social	Community events and activities		Yes						Yes	Condition of natural cultural heritage (e.g. scar trees, heritage vineyard, springs, rivers, burial grounds)	Condition of natural cultural heritage	Heat wave increase frequency and intensity	5	5 - High	5	Vegetation sensitive to extreme heat	10		3	Current maintenance is not designed or resourced to cope with future climate, Some irrigation could be applied, but not currently in place	17
Social	Community events and activities		Yes						Yes	Condition of natural cultural heritage (e.g. scar trees, heritage vineyard, springs, rivers, burial grounds)	Condition of natural cultural heritage	Rainfall intensity increase	5	4 - Moderate to High	4	Condition likely to be sensitive to inundation from flooding.	9	Protection under Aboriginal Heritage Act	5	Current maintenance is not designed or resourced to cope with future climate	14
Economic and Infrastructure	Business and Industry						Yes			Contribution to GRP	Construction and Wholesale Trade sector	Sea level rise	5	5 - High	5	May require building / facility changes or relocation	10		2	Larger industries may have other facilities to move, if part of large supply chain may be considering vulnerability already as risk to business and have more resources to respond, small businesses unlikely to have as much AC If move outside the region, GRP will be reduced	18
Economic and Infrastructure	Business and Industry						Yes			Contribution to GRP	Manufacturing sector	Sea level rise	5	5 - High	5	May require building / facility changes or relocation	10		2	Larger industries may have other facilities to move, if part of large supply chain may be considering vulnerability already as risk to business and have more resources to respond, small businesses unlikely to have as much AC If move outside the region, GRP will be reduced	18
Economic and Infrastructure	Business and Industry						Yes			Contribution to GRP	Transport Postal Warehousing sector	Sea level rise	5	5 - High	5	May require building / facility changes or relocation	10		2	Larger industries may have other facilities to move, if part of large supply chain may be considering vulnerability already as risk to business and have more resources to respond, small businesses unlikely to have as much AC If move outside the region, GRP will be reduced	18
Economic and Infrastructure	Business and Industry						Yes			Contribution to GRP	Construction and Wholesale Trade sector	Heat wave increase frequency and intensity	5	4 - Moderate to High	4	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	9		5	Changes may be required to employment conditions (OHS), scheduling, larger companies may have better AC, SMEs likely to have lower AC	14

Grouping	Subgroup	Coastal Environment	Biodiversity	Coastal and Riverine WQ	Stormwater	Infrastructure and Essential Services	Productivity and economy	Community	Attenity and Quality of Life	Indicator /s	Feature to score	Exposure (Climate Variable)	Exposure Score	Sensitivity to Climate Variable	Sensitivity Score	Comment	Potential Impact	Comment on Adaptive Capacity from Research Papers	Adaptive Capacity Score	Adaptive Capacity Workshop Comment	Vulnerability Score
Economic and Infrastructure	Business and Industry						Yes			Contribution to GRP	Manufacturing sector	Heat wave increase frequency and intensity	5	3 - Moderate	3	Impacts on workers in unairconditioned buildings and facilities, outdoor etc. are sensitive to high heat	8		5	Changes may be required to employment conditions (OHS), scheduling etc.	13
Economic and Infrastructure	Business and Industry						Yes			Contribution to GRP	Transport Postal Warehousing sector	Heat wave increase frequency and intensity	5	3 - Moderate	3	Impacts on workers in unairconditioned buildings and facilities, outdoor etc. are sensitive to high heat	8		5	Changes may be required to employment conditions (OHS), scheduling etc.	13
Economic and Infrastructure	Business and Industry						Yes			Contribution to GRP	Transport Postal Warehousing sector	Rainfall intensity increase	5	2 - Low to Moderate	2	Flood water impacts with surface water disrupt access, supply chain and operations in short term, roads may also be flooded	7		5	Rainfall short term but impacts of flooding on roads and other transport infrastructure,	12
Economic and Infrastructure	Business and Industry						Yes			Contribution to GRP	Construction and Wholesale Trade sector	Rainfall intensity increase	5	3 - Moderate	3	Flood water impacts with surface water disrupt access, supply chain and operations in short term, construction sector may be more sensitive as more outdoor work	8		7	Rainfall short term event so outdoor construction workers may be able to return to work shortly after	11
Economic and Infrastructure	Business and Industry						Yes			Contribution to GRP	Manufacturing sector	Rainfall intensity increase	5	2 - Low to Moderate	2	Flood water impacts with surface water disrupt access, supply chain and operations in short term	7		7	Rainfall short term event	10
Social	Support services								Yes	Demand for emergency services	Demand for emergency services	Rainfall intensity increase	5	5 - High	5	Emergency services very likely to be required for life and property protection	10		3	Detention basins, stormwater management infrastructure, high level of awareness of flood risk in community already, but not for some renters, new migrants etc. BHKC not fixed as yet. Flood Safe program. Increased run off due to development	17
Social	Support services								Yes	Demand for emergency services	Demand for emergency services	Sea level rise	5	5 - High	5	Emergency services very likely to be required for life and property protection but some early warning would occur if people are aware and listening	10		3	Storm surge will become an increasing issue. Sandbagging.	17
Social	Support services								Yes	Demand for emergency services	Demand for emergency services	Heat wave increase frequency and intensity	5	5 - High	5	Emergency services (ambulance, hospitals) very likely to be required	10	During heat waves, additional ambulance staff put on to address increased callouts.	8	Heat Safe program from SES, warning systems, disruption to power supply impacts ability to cool. Will increase demand for ambulances. SES and BOM call extreme heat warning, action is initiated-eg specific contact made to vulnerable people via Red Cross. SES dependent on volunteers but MFS and ambulance paid. Information provision about coping with heat. Emergency services working well currently together. People living alone particularly vulnerable and those experiencing socio-economic disadvantage. other services check on people eg Meals on Wheels. Medic alert wearers can utilise to call for help.	12
Economic and Infrastructure	Open Space and Recreation	Yes				Yes			Yes	Effective functioning of active recreation and sporting sites (indoor and outdoor)	Indoor facilities	Sea level rise	5	4 - Moderate to High	4	Inundation likely to cause damage to contents and possibly structure of facilities	9	Council owned assets subject to asset management plans, private facilities may have less adaptive capacity, stormwater management plans, flood mitigation actions	1	Finished floor levels, planning policy, building code etc sandbagging, emergency responses, assets management planning, pumping, existing sea walls/structures along the river developed 100 years ago but don't protect from SLR	18
Economic and Infrastructure	Open Space and Recreation	Yes				Yes			Yes	Effective functioning of active recreation and sporting sites (indoor and outdoor)	Outdoor grassed facilities	Sea level rise	5	4 - Moderate to High	4	Grassed areas highly sensitive to inundation from sea water	9	Council owned assets subject to asset management plans, private facilities may have less adaptive capacity	2	Grass doesn't like saltwater. Limited if any protection structures in place	17
Economic and Infrastructure	Open Space and Recreation	Yes				Yes			Yes	Effective functioning of active recreation and sporting sites (indoor and outdoor)	Outdoor grassed facilities	Heat wave increase frequency and intensity	5	4 - Moderate to High	4	Irrigated grass areas sensitive to heat waves	9	Council owned assets subject to asset management plans, private facilities may have less adaptive capacity, stormwater management plans, flood mitigation actions	4	Not coping well now due to lack of water and soil profile. Some irrigation from bore water, recycled stormwater. General demand increase for water. Impact ability for different levels of competition to play due to hardening/compacting of surfaces. Ground treatment like gypsum to capture water/improve permeability. IPOS standards re irrigation for different. Use of drought tolerant species for turf.	15
Economic and Infrastructure	Open Space and Recreation	Yes				Yes			Yes	Effective functioning of active recreation and sporting sites (indoor and outdoor)	Outdoor paved / hard facilities	Sea level rise	5	3 - Moderate	3	Paved areas could require increased maintenance, less sensitive than grassed areas	8	Council owned assets subject to asset management plans, private facilities may have less adaptive capacity, stormwater management plans, flood mitigation actions, coastal inundation responses eg sea wall could contribute	3	Undermining, damage to surfaces	15

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Economic and Infrastructure	Open Space and Recreation	Yes				Yes			Yes	Effective functioning of active recreation and sporting sites (indoor and outdoor)	Indoor facilities	Heat wave increase frequency and intensity	5	4 - Moderate to High	4	Quality of indoor facilities likely to be affected by heat as use likely to increase during heat waves, potential increase in maintenance to building exterior	9	Council owned assets subject to asset management plans, private facilities may have less adaptive capacity	6	More difficult to cool, heating, ventilation, air conditioning. Increased energy costs increased risk of power disruption. If run by Communities/Councils may not be able to cover costs. Often building structure are light weight/shed design. Conflicts over use/interruption to sporting/recreation events. Increased demand for use if is a cooled space. asset management plans, long term financial plans, which are updated and responded to overtime. service interruption less able to control	13
Economic and Infrastructure	Open Space and Recreation	Yes				Yes			Yes	Effective functioning of active recreation and sporting sites (indoor and outdoor)	Outdoor paved / hard facilities	Heat wave increase frequency and intensity	5	3 - Moderate	3	Less sensitive to heat waves than grassed areas, increased hot weather could require more frequent maintenance due to cracking of surfaces	8	Council owned assets subject to asset management plans, private facilities may have less adaptive capacity, stormwater management plans, flood mitigation actions, coastal inundation responses eg sea wall could contribute	5	Cracking, melt, soil movement. Reduced use due to poor amenity from radiating heat. Already reschedule tennis to evenings. Installed lighting. Colour of surface (ie not black). Asset management plans. No shade canopy so roots don't disrupt surfaces.	13
Economic and Infrastructure	Open Space and Recreation	Yes				Yes			Yes	Effective functioning of active recreation and sporting sites (indoor and outdoor)	Outdoor grassed facilities	Rainfall intensity increase	5	4 - Moderate to High	4	Sensitive to impacts of flooding possible in short term, drainage issues, safety	9	Council owned assets subject to asset management plans, private facilities may have less adaptive capacity, stormwater management plans, flood mitigation actions	7	Flooding, events cancelled, damage to surfaces, erosion, water logged and compaction. Soil profile can help mitigate this. Sub surface drainage. Often located in low points. Some locations in region have less AC than others	12
Economic and Infrastructure	Open Space and Recreation	Yes				Yes			Yes	Effective functioning of active recreation and sporting sites (indoor and outdoor)	Outdoor paved / hard facilities	Rainfall intensity increase	5	4 - Moderate to High	4	Sensitive to impacts of flooding possible in short term, more likely to be sensitive to erosion than grassed facilities	9	Council owned assets subject to asset management plans, private facilities may have less adaptive capacity, irrigation management, alternate water sources from MAR schemes (eg golf courses)	8	will contribute to localised flooding due to run off. Can undermine and accelerate deterioration if already cracked. Design standards in place.	11
Economic and Infrastructure	Open Space and Recreation	Yes				Yes			Yes	Effective functioning of active recreation and sporting sites (indoor and outdoor)	Outdoor grassed facilities	Rainfall reduction: winter-spring	5	5 - High	5	Quality of grassed areas will be reduced as rainfall decreases, and use of facilities increases as weather more suitable for outdoor activities	10	Council owned assets subject to asset management plans, private facilities may have less adaptive capacity, stormwater management plans, flood mitigation actions, coastal inundation responses eg sea wall could contribute	9	Requirement for more irrigation. Overall condition may be improved if less rainfall overall? IPOS water budgeting -shift in irrigation regime/extend irrigation season	11
Economic and Infrastructure	Open Space and Recreation	Yes				Yes			Yes	Effective functioning of active recreation and sporting sites (indoor and outdoor)	Indoor facilities	Rainfall intensity increase	5	3 - Moderate	3	Structures may be sensitive to damage from intense rain events and flooding	8	Council owned assets subject to asset management plans, private facilities may have less adaptive capacity, irrigation management, alternate water sources from MAR schemes (eg golf courses)	8	Flooding of buildings, damage to infrastructure. Increased disruption to use/ may not be able to access building due to flooding. Some buildings capture stormwater. Asset management plans.	10
Economic and Infrastructure	Open Space and Recreation	Yes				Yes			Yes	Effective functioning of active recreation and sporting sites (indoor and outdoor)	Outdoor paved / hard facilities	Rainfall reduction: winter-spring	5	2 - Low to Moderate	2	Hard surface facilities less sensitive	7	Council owned assets subject to asset management plans, private facilities may have less adaptive capacity, shade structures	10	Could result in increased soil movement and undermine surfaces.	7
Economic and Infrastructure	Buildings and Infrastructure	Yes			Yes	Yes				Effective functioning of built assets and contents (houses)	Public housing - buildings and contents	Sea level rise	5	5 - High	5	May require building structural changes or relocation	10	Housing SA or other organisation repair but may be delay if many properties affected, owners may have lower rates of contents insurance, reliance on community organisations for assistance following flooding	2		18
Economic and Infrastructure	Buildings and Infrastructure	Yes			Yes	Yes				Effective functioning of built assets and contents (houses)	Public housing - buildings and contents	Rainfall intensity increase	5	4 - Moderate to High	4	Public housing may be less well maintained and hence more sensitive than private housing	9	Housing SA or other organisation repair but may be delay if many properties affected, owners may have lower rates of contents insurance, reliance on community organisations for assistance following flooding	2	Repair and rebuild responsibility of government but contents responsibility of residents so may have less ability to replace damaged contents	17
Economic and Infrastructure	Buildings and Infrastructure	Yes			Yes	Yes				Effective functioning of built assets and contents (houses)	Houses / residential buildings and contents (privately owned) - Older houses with lower finished flood levels	Rainfall reduction: winter-spring	5	4 - Moderate to High	4	Bluestone footings more susceptible to soil heavage damage as soil moisture levels reduce	9	Private owners more likely to have insurance to cover costs of damages, able to arrange own repairs	2	Limited adaptive capacity - costly for private owners to stabilise footings.	17
Economic and Infrastructure	Buildings and Infrastructure	Yes			Yes	Yes				Effective functioning of built assets and contents (houses)	Houses / residential buildings and contents (privately owned) - Older houses with lower finished flood levels	Sea level rise	5	5 - High	5	May require building structural changes or relocation	10		3	Flood insurance not likely to cover all damage, some areas may not event get flood insurance SMPs Building materials have big influence on requirements for repair following flood damage. Less solid materials may result in higher costs of repair or even replacement of buildings	17
Economic and Infrastructure	Buildings and Infrastructure	Yes			Yes	Yes				Effective functioning of built assets and contents (houses)	Houses / residential buildings and contents (privately owned) - Newer houses with higher finished flood levels	Sea level rise	5	5 - High	5	Higher finished floor levels of new houses however possibly less robust construction	10		3	Flood insurance not likely to cover all damage, some areas may not event get flood insurance SMPs Building materials have big influence on requirements for repair following flood damage. Less solid materials may result in higher costs of repair or even replacement of buildings Newer buildings have higher finished flood levels	17

Grouping	Subgroup	Coastal Environment	Biodiversity	Coastal and Riverine WQ	Stormwater	Infrastructure and Essential Services	Productivity and economy	Community	Amenity and Quality of Life	Indicator /s	Feature to score	Exposure (Climate Variable)	Exposure Score	Sensitivity to Climate Variable	Sensitivity Score	Comment	Potential Impact	Comment on Adaptive Capacity from Research Papers	Adaptive Capacity Score	Adaptive Capacity Workshop Comment	Vulnerability Score
Economic and Infrastructure	Buildings and Infrastructure	Yes			Yes	Yes				Effective functioning of built assets and contents (houses)	Houses / residential buildings and contents (privately owned) - Older houses with lower finished flood levels	Rainfall intensity increase	5	4 - Moderate to High	4	Flood water short term impacts affecting access and damage to contents and structure Older buildings have lower FFL but generally more robust construction	9	Private owners more likely to have insurance to cover costs of damages, able to arrange own repairs	3	Flood insurance not likely to cover all damage, some areas may not event get flood insurance SMPs Building materials have big influence on requirements for repair following flood damage.	16
Economic and Infrastructure	Buildings and Infrastructure	Yes			Yes	Yes				Effective functioning of built assets and contents (houses)	Houses / residential buildings and contents (privately owned) - Newer houses with higher finished flood levels	Rainfall intensity increase	5	4 - Moderate to High	4	Flood water short term impacts affecting access and damage to contents and structure Newer buildings have higher finished flood levels	9	Private owners more likely to have insurance to cover costs of damages, able to arrange own repairs	3	Flood insurance not likely to cover all damage, some areas may not event get flood insurance SMPs Building materials have big influence on requirements for repair following flood damage. Less solid materials may result in higher costs of repair or even replacement of buildings	16
Economic and Infrastructure	Open Space and Recreation	Yes				Yes			Yes	Effective functioning of cycling and walking infrastructure (e.g. footpaths etc.)	Cycling and walking infrastructure	Sea level rise	5	4 - Moderate to High	4	Possibly more sensitive as not built to road standards, sensitive to coastal erosion	9	Council asset management plans	1		18
Economic and Infrastructure	Open Space and Recreation	Yes				Yes			Yes	Effective functioning of cycling and walking infrastructure (e.g. footpaths etc.)	Cycling and walking infrastructure	Heat wave increase frequency and intensity	5	4 - Moderate to High	4	Impact of heat on bitumen	9	Council asset management plans	6	Soil movement, undermining of surfaces, reduced use, amenity, accelerated deterioration of bitumen, concrete, asset management plans, some paths are shaded by trees, building canopy so less exposed to heat, different standard based on level of use (eg not performance standard like tennis court hard surface)	13
Economic and Infrastructure	Open Space and Recreation	Yes				Yes			Yes	Effective functioning of cycling and walking infrastructure (e.g. footpaths etc.)	Cycling and walking infrastructure	Rainfall intensity increase	5	3 - Moderate	3	Sensitive to erosion on path edges	8	Stormwater management plans, council asset management plans	7	Undermining, damage to surfaces, erosion, often along drainage corridors so flooded and reduced use	11
Economic and Infrastructure	Open Space and Recreation	Yes				Yes			Yes	Effective functioning of open space (predominantly green space)	Condition of open space	Heat wave increase frequency and intensity	5	4 - Moderate to High	4	Grass and landscaped areas possibly sensitive to heat waves. Risk of trees falling on residents.	9	WSUD providing alternate water source for irrigation, irrigation management plans, open space management plans	5	Some irrigation of open space. Hierarchy of irrigation (eg playing fields higher priority than open space). Not enough water budget in IPOS (ie water per month) for peak periods to sustain grass condition. Change in species selection/ water wise planting already happening. Expectations re amenity is changing. grass struggles, plants surrounding perimeter are drought tolerant. New trees are irrigated so can establish	14
Economic and Infrastructure	Open Space and Recreation	Yes				Yes			Yes	Effective functioning of open space (predominantly green space)	Condition of open space	Rainfall intensity increase	5	3 - Moderate	3	Quality of grassed areas sensitive to prolonger periods of inundation	8	Open space management plans, stormwater management plans	7	Many are detention basins, so reduced use. Increased mosquitoes. Nature of open space changing as incorporate water detention, useability decreased, increased pollutants as less rainfall overall	11
Economic and Infrastructure	Open Space and Recreation	Yes				Yes			Yes	Effective functioning of open space (predominantly green space)	Condition of open space	Rainfall reduction: winter-spring	5	4 - Moderate to High	4	Quality of grassed areas will be reduced as rainfall decreases and use of open space may increase as weather more suitable for outdoor activities	9	WSUD providing alternate water source for irrigation, irrigation management plans, open space management plans	8	Loss of amenity. Reduced mowing regime and cost savings. Extend irrigation season, drought tolerant plants	11
Economic and Infrastructure	Open Space and Recreation	Yes				Yes			Yes	Effective functioning of public realm (constructed assets, fountains etc.)	Constructed assets	Sea level rise	5	3 - Moderate	3	Inundation may cause direct damage or impacts to soil stability, salt could affect materials	8	Council asset management plans	1	Accelerated deterioration, increased use of shade structures over paving, street furniture selection driven by cost not climate considerations and not whole of life. Reduced rainfall switch off fountains/ water features, lakes which speeds up deterioration	17
Economic and Infrastructure	Open Space and Recreation	Yes				Yes			Yes	Effective functioning of public realm (constructed assets, fountains etc.)	Constructed assets	Heat wave increase frequency and intensity	5	3 - Moderate	3	Some materials (plastics and metals) sensitive to high temperatures	8	Council asset management plans	7	Accelerated deterioration, increased use of shade structures over paving, street furniture selection driven by cost not climate considerations and not whole of life. Reduced rainfall switch off fountains/ water features, lakes which speeds up deterioration due to lack of use. Australia standards will help cope, these assets are turned over more frequently, so opportunity to improve over time greater	11
Economic and Infrastructure	Open Space and Recreation	Yes				Yes			Yes	Effective functioning of public realm (green assets - trees and landscaping)	Green assets - trees and landscaping	Heat wave increase frequency and intensity	5	5 - High	5	Heat waves can cause damage and death to green assets	10	Council owned assets subject to asset management plans, irrigation management, alternate water sources from MAR schemes	3	Drying of soil, evapotranspiration, limb drop, increased public risk. Water trucks for irrigation. Encourage residents to water street trees. Drought tolerant species selection. Rain gardens, WSUD. Community gardens on verges and community ownership/responsibility	17
Economic and Infrastructure	Open Space and Recreation	Yes				Yes			Yes	Effective functioning of public realm (green assets - trees and landscaping)	Green assets - trees and landscaping	Rainfall reduction: winter-spring	5	5 - High	5	Vegetation sensitive to reduced soil moisture conditions that result from lower winter rainfall Street trees in particular sensitive to reduced rainfall and lower soil moisture. Recent droughts seen reductions in plant health and tree death	10	Council owned assets subject to asset management plans, irrigation management, alternate water sources from MAR schemes	7	Drying of soil, evapotranspiration, limb drop, increased public risk. Water trucks for irrigation. Encourage residents to water street trees. Drought tolerant species selection. Rain gardens, WSUD. Community gardens on verges and community ownership/responsibility .	13
Economic and Infrastructure	Open Space and Recreation	Yes				Yes			Yes	Effective functioning of public realm (green assets - trees and landscaping)	Green assets - trees and landscaping	Rainfall reduction: summer-autumn	2	3 - Moderate	3	Vegetation sensitive to reduced episodic rainfall during summer	5	Council owned assets subject to asset management plans, irrigation management, alternate water sources from MAR schemes	3	Drying of soil, evapotranspiration, limb drop, increased public risk. Water trucks for irrigation. Encourage residents to water street trees. Drought tolerant species selection. Rain gardens, WSUD. Community gardens on verges and community ownership/responsibility .	12

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Economic and Infrastructure	Open Space and Recreation	Yes				Yes			Yes	Effective functioning of public realm (green assets - trees and landscaping)	Green assets - trees and landscaping	Temperature increase	5	3 - Moderate	3	Hotter temperatures stress tree and vegetation health	8	Council owned assets subject to asset management plans, irrigation management, alternate water sources from MAR schemes	6	UHI effect. Species selection, WSUD, urban design. Some species will grow faster due to warmer conditions overall. Turn over of trees depending on species. Tree planting programs to replace. Tree management plans. Trees need more water	12
Economic and Infrastructure	Open Space and Recreation	Yes				Yes			Yes	Effective functioning of public realm (green assets - trees and landscaping)	Green assets - trees and landscaping	Rainfall intensity increase	5	3 - Moderate	3	Landscape features sensitive to flooding and associated erosion	8	Council asset management plans, stormwater management plans	7	Erosion, tree failure particularly if stressed after heatwave. If ground saturated after heavy rain, trees fail. Often combined with storm event. Tree inspection regime, WSUD, green infrastructure planning, integrated of stormwater management, tree register	11
Economic and Infrastructure	Open Space and Recreation	Yes				Yes			Yes	Effective functioning of recreation facilities (e.g. SLSC, playgrounds)	SLSC	Sea level rise	5	5 - High	5	Sensitive to erosive impacts of slr and storm surge	10		2	design techniques to accommodate temporary inundation, has top be located along the coast, recent refurbishment means built to most up to date policy/projections. Existing protection works	18
Economic and Infrastructure	Open Space and Recreation	Yes				Yes			Yes	Effective functioning of recreation facilities (e.g. SLSC, playgrounds)	Playgrounds	Sea level rise	5	3 - Moderate	3	SLR impacts on condition (flooding and erosion) and ability for use	8		1	Can deconstruct and relocate to alternative location	17
Economic and Infrastructure	Open Space and Recreation	Yes				Yes			Yes	Effective functioning of recreation facilities (e.g. SLSC, playgrounds)	Playgrounds	Heat wave increase frequency and intensity	5	4 - Moderate to High	4	Some materials (plastics and metals) sensitive to high temperatures	9		7	Reduced use, demand for shade, accelerated deterioration, lack of amenity, equipment getting hotter. Public risk. Nature playspaces, less modular/metal/plastic. Shade policy for playgrounds. Asset management plans. Hierarchy of playspaces and maintenance regime etc	12
Economic and Infrastructure	Open Space and Recreation	Yes				Yes			Yes	Effective functioning of recreation facilities (e.g. SLSC, playgrounds)	SLSC	Heat wave increase frequency and intensity	5	3 - Moderate	3	Structural impacts as well as those associated with increased demand / use during periods of hot weather	8	Shading of playgrounds, council asset management plans, stormwater management plans	8	Increased use/demand, accelerated deterioration, power disruption, HVAC	10
Economic and Infrastructure	Open Space and Recreation	Yes				Yes			Yes	Effective functioning of recreation facilities (e.g. SLSC, playgrounds)	Playgrounds	Rainfall intensity increase	5	3 - Moderate	3	SLR impacts on condition (flooding and erosion) and ability for use	8	Council asset management plans	9	Use alternative facility. Some limited damage. Bark chips/rubber soft fall affected by flooding. Frequent monitoring and maintenance regime. Equipment standards re construction	9
Economic and Infrastructure	Water / Engineering				Yes	Yes				Effective functioning of stormwater management infrastructure (drains, gutters, pipes)	Above ground infrastructure (gutters, drains, pump stations)	Rainfall intensity increase	5	5 - High	5	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	10	Stormwater management plans, council asset management plans	1	Very low. Infrastructure would need to be replaced. All systems are designed to an ARI level, once this changes need to redesign. Or change community expectations. Developers tend to go with bare minimum standards. Current day, already behind eight ball. A lot of systems are already under capacity	19
Economic and Infrastructure	Water / Engineering				Yes	Yes				Effective functioning of stormwater management infrastructure (drains, gutters, pipes)	Below ground infrastructure	Sea level rise	5	5 - High	5	Erosion at outlet, sea water intrusion to stormwater infrastructure will	10	Stormwater management plans, council asset management plans	1	Very low adaptive capacity	19
Economic and Infrastructure	Water / Engineering				Yes	Yes				Effective functioning of stormwater management infrastructure (drains, gutters, pipes)	Above ground infrastructure (gutters, drains, pump stations)	Sea level rise	5	3 - Moderate	3	Pump stations designed to cope with surface inundation	8	Stormwater management plans, council asset management plans	3	Impact on pump stations is mid range. Impact on flow paths is high.	15
Economic and Infrastructure	Water / Engineering				Yes	Yes				Effective functioning of stormwater management infrastructure (drains, gutters, pipes)	Below ground infrastructure	Rainfall reduction: winter-spring	5	3 - Moderate	3	Damage to underground infrastructure as result of soil heavage caused by changes in soil moisture, infrastructure design capacity may not be sufficient for higher flows	8	Stormwater management plans, council asset management plans	8	Almost beneficial	10
Economic and Infrastructure	Water / Engineering						Yes		Yes	Effective functioning of tourist facilities (e.g. Henley Square, Port Wharf markets, Adelaide Shores etc.)	Tourist facilities	Heat wave increase frequency and intensity	5	3 - Moderate	3	Increased maintenance to exteriors exposed to greater heat	8			Was not scored - Group could not see difference between this indicator and "tourism infrastructure" feature	
Economic and Infrastructure	Water / Engineering						Yes		Yes	Effective functioning of tourist facilities (e.g. Henley Square, Port Wharf markets, Adelaide Shores etc.)	Tourist facilities	Sea level rise	5	5 - High	5	SLR impacts on condition (flooding and erosion) and ability for use	10			Was not scored - Group could not see difference between this indicator and "tourism infrastructure" feature	
Economic and Infrastructure	Water / Engineering						Yes		Yes	Effective functioning of tourist facilities (e.g. Henley Square, Port Wharf markets, Adelaide Shores etc.)	Tourist facilities	Sea level rise	5	5 - High	5	SLR impacts on condition (flooding and erosion) and ability for use	10		4	AC will vary between sites. Some infrastructure has moderate AC other sites have low AC	16
Economic and Infrastructure	Water / Engineering						Yes		Yes	Effective functioning of tourist facilities (e.g. Henley Square, Port Wharf markets, Adelaide Shores etc.)	Tourist facilities	Heat wave increase frequency and intensity	5	3 - Moderate	3	Increased maintenance to exteriors exposed to greater heat	8		5	Shade structure plan has been prepared. Commencing container shade structures	13
Economic and Infrastructure	Business and Industry	Yes				Yes	Yes			Effective operation of airport	Airport facilities	Sea level rise	5	4 - Moderate to High	4	The drainage systems for airports are sensitive to SLR reducing capacity of drainage systems for runway aprons for moving planes to and from terminals. The runway itself is still less sensitive but any saltwater intrusion and inundation is likely to accelerate degradation of the asset. The terminal buildings are not likely to be sensitive to SLR related flooding.	9	Adelaide Airport Master Plan	4	The adaptive capacity of the airport runway apron etc is low. These assets can't be easily moved and loss of functionality of plane access will limit airport operational performance. Areas that are inundated through tidal flooding may have extended periods of exclusion of use to reduce damage to pavement integrity.	15

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Economic and Infrastructure	Business and Industry					Yes	Yes			Effective operation of airport	Airport facilities	Heat wave increase frequency and intensity	5	3 - Moderate	3	The airport runways and flight apron (for taxi of aircraft to/from terminal to runway) are of a design standard that is highly resistant to high temperatures. The issue is more to do with heavy aircraft requiring longer runways to take off safely at higher temperatures. The level of refuelling is also reduced at higher temperatures that may impact ability to support long haul flights from this airport during summer. The airport terminal is less sensitive to heatwave impacts due to design but is sensitive to extended loss of power that may occur during a heatwave. The drainage systems for airports are designed to provide high safety margins for landing and moving planes to and from terminals. The terminal buildings and maintenance sheds are sensitive to flooding of offices, furnishings, electrical and computer systems. Particularly if hail storm is following by flooding rain. The hail blocks drainage systems typically causing internal flooding. The flooding sensitivity of access roads into and through airport is a short term disruption at worst due to design of drainage. Flooding sensitivity of carpark is low as public carparks is at grade level and not underground. Limited parking & dispatch delivery areas may exist below grade level and would be more sensitive to flooding but impact to operations would be limited.	8	Adelaide Airport Master Plan	7	The design of the airport has a relatively high ability to manage heatwaves from procedures to back up energy supply and redundancy for air traffic control. The management of summer heatwave through re-scheduling flights for non-peak heat times is an applied adaptive approach already applied in hotter climate airports.	11
Economic and Infrastructure	Business and Industry				Yes	Yes	Yes			Effective operation of airport	Airport facilities	Rainfall intensity increase	5	3 - Moderate	3	The drainage systems for airports are designed to provide high safety margins for landing and moving planes to and from terminals. The terminal buildings and maintenance sheds are sensitive to flooding of offices, furnishings, electrical and computer systems. Particularly if hail storm is following by flooding rain. The hail blocks drainage systems typically causing internal flooding. The flooding sensitivity of access roads into and through airport is a short term disruption at worst due to design of drainage. Flooding sensitivity of carpark is low as public carparks is at grade level and not underground. Limited parking & dispatch delivery areas may exist below grade level and would be more sensitive to flooding but impact to operations would be limited.	8	Adelaide Airport Master Plan, stormwater management plans	7	The facilities have a high capacity to respond and only major event would cause loss of electrical systems. Redundancy offsite for data systems is likely and can enable recovery of systems. Damage to carpets and furnishings can temporarily close terminal gates but generally redundancy of gates would allow continued operation so capacity is relatively high.	11
Economic and Infrastructure	Buildings and Infrastructure	Yes					Yes			Effective operation of built assets and contents (business and industry)	Commercial and industrial buildings (private) SME	Sea level rise	5	5 - High	5	May require building structural changes or relocation	10	Privately owned buildings may have insurance but only larger organisations / industries likely to be considering climate change	1	SME lower AC as less insurance, rented buildings, less able to recover, history elsewhere has shown SMEs less likely to recover and prosper following disaster events	19
Economic and Infrastructure	Buildings and Infrastructure				Yes		Yes			Effective operation of built assets and contents (business and industry)	Commercial and industrial buildings (private) SME	Rainfall intensity increase	5	4 - Moderate to High	4	Potentially sensitive and valuable contents inside buildings, building itself may be less sensitive SME more sensitive Possibly in rented buildings, not totally fit for purpose and lower insurance levels	9	Privately owned buildings may have insurance but only larger organisations / industries likely to be considering climate change	1	SME lower AC as less insurance, rented buildings, less able to recover, history elsewhere has shown SMEs less likely to recover and prosper following disaster events	18
Economic and Infrastructure	Buildings and Infrastructure	Yes					Yes			Effective operation of built assets and contents (business and industry)	Commercial and industrial buildings (private) Larger enterprises	Sea level rise	5	5 - High	5	May require building structural changes or relocation	10		6	Larger industries more regulated, may have other facilities to move, if part of large supply chain may be considering vulnerability already as risk to business, more resources to respond	14
Economic and Infrastructure	Buildings and Infrastructure				Yes		Yes			Effective operation of built assets and contents (business and industry)	Commercial and industrial buildings (private) Larger enterprises	Rainfall intensity increase	5	4 - Moderate to High	4	Potentially sensitive and valuable contents inside buildings, building itself may be less sensitive Larger enterprises	9		6	Larger industries more regulated, may have other facilities to move, if part of large supply chain may be considering vulnerability already as risk to business, more resources to respond	13
Economic and Infrastructure	Buildings and Infrastructure	Yes				Yes				Effective operation of coastal assets	Existing sea walls	Sea level rise	5	5 - High	5	Older sea walls less well constructed and many areas have been seen to be damaged in storm events	10		1	Existing older walls require more regular maintenance and built to different standards, limited funding available, management and maintenance responsibilities unclear	19

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Economic and Infrastructure	Buildings and Infrastructure	Yes				Yes				Effective operation of coastal assets	Jetties	Sea level rise	5	5 - High	5	Jetties in particular are known to be highly sensitive to large storm surge events. Direct physical damage can occur to jetties, boat ramps and marinas during storm surge events. Increasing periods of temporary inundation will impact ability to use the facilities. These structures are important for the local community and people visiting the region	10	DPTI asset management	2	Rebuild is generally option for future SLR, very expensive , heritage issues also (listing - Henley Jetty)	18
Economic and Infrastructure	Buildings and Infrastructure	Yes				Yes				Effective operation of coastal assets	Beach access paths	Sea level rise	5	5 - High	5	Beach paths sensitive to coastal inundation and erosion. Direct physical damage can occur during storm surge events. Increasing periods of temporary inundation will impact ability to use the facilities.	10		2	Higher expense and regular costs for Councils, reshaping after storms, may need more stairs in the future down sea walls to enable access.	18
Economic and Infrastructure	Buildings and Infrastructure	Yes				Yes				Effective operation of coastal assets	Boat ramps	Sea level rise	5	4 - Moderate to High	4	Boat ramps sensitive to coastal inundation and erosion. Direct physical damage can occur during storm surge events. Increasing periods of temporary inundation will impact ability to use the facilities.	9	Council asset management plans, boating facilities fund can fund upgrades	4	Some boat ramps currently not maintained at all Some Council maintained More recent boat ramps have been designed to cope with future conditions (eg West Beach associated with marina) Older ramps have lower SC Relatively easy to replace or repair	15
Economic and Infrastructure	Buildings and Infrastructure	Yes				Yes				Effective operation of coastal assets	Marina	Sea level rise	5	5 - High	5	Increased sea level may require upgrade of infrastructure, some floating infrastructure could be less sensitive. Direct physical damage can occur during storm surge events. Increasing periods of temporary inundation will impact ability to use the facilities.	10		7	Greater resources available, more likely to have assets insured, private assets, relatively new so likely to be able to cope with tidal range plus SLR, well adapted through design	13
Economic and Infrastructure	Business and Industry						Yes			Effective operation of defence industries	Defence industries	Sea level rise	5	5 - High	5	May require building / facility changes or relocation	10		3	Assumed new facilities / buildings were constructed with high finished flood level to account for potential high water and salt water / spray impacts Some older buildings were built late 80s early 90s so may not have considered SLR	17
Economic and Infrastructure	Business and Industry						Yes			Effective operation of defence industries	Defence industries	Heat wave increase frequency and intensity	5	4 - Moderate to High	4	Impacts to workers in unairconditioned buildings and facilities, outdoor etc. are sensitive to high heat, ASC in particular, other suppliers etc as well	9		4	Higher AC than general manufacturing due to scale and nature of industry, likely to have systems in place to protect high value infrastructure and plant	15
Economic and Infrastructure	Business and Industry						Yes			Effective operation of defence industries	Defence industries	Rainfall intensity increase	5	3 - Moderate	3	Access could be restricted by floodwaters, impacts to supply chain rather than direct industry	8		7	Likely to have systems in place to protect high value infrastructure and plant from flooding	11
Economic and Infrastructure	Business and Industry					Yes	Yes			Effective operation of electricity supply	Electricity infrastructure	Heat wave increase frequency and intensity	5	5 - High	5	Power line sag, increase demand for electricity during heat wave places stress on electricity distribution, system already shown to be sensitive during recent heatwaves, cooling water could be affected also at TI power station	10	SA Power Networks asset management systems	3	Actions generally aim to reduce damage to assets so involve switching off which does not contribute to reducing the interruptions. Does not address increased capacity needed in network overall to prevent/reduce disruption.	17
Economic and Infrastructure	Business and Industry					Yes	Yes			Effective operation of electricity supply	Electricity infrastructure	Sea level rise	5	5 - High	5	Torrens Power Station included. Substations would be sensitive to inundation, impacts on access and operations of power station, foundations of transmission lines	10	SA Power Networks asset management systems	3	Existing network will have high adaptive capacity to periodic flooding in some low lying areas but not designed to cope with permanent inundation as sea level rises	17
Economic and Infrastructure	Business and Industry					Yes	Yes			Effective operation of electricity supply	Electricity infrastructure	Rainfall intensity increase	5	3 - Moderate	3	Substations could be flooded which would interrupt supply in short term	8	SA Power Networks asset management systems, stormwater management plans	3	Existing network will have high adaptive capacity to periodic flooding in some low lying areas. However, storm conditions may result in trees coming down on power lines, power lines touching and therefore being switched off etc.	15
Economic and Infrastructure	Business and Industry	Yes				Yes	Yes			Effective operation of port facilities	Port facilities	Rainfall intensity increase	5	5 - High	5	The port operations are very sensitive to flooding on landside impacting assets critical for operations such as electricity substations, transport access and storage facilities.	10	Stormwater management plans	3	The procedures to protect landside assets are likely to exist but are usually inadequate to manage higher magnitude extreme events in the future.	17
Economic and Infrastructure	Business and Industry	Yes				Yes	Yes			Effective operation of port facilities	Port facilities	Sea level rise	5	5 - High	5	The port operations are very sensitive to sea level rise on landside impacting assets critical for operations such as electricity substations, transport access and storage facilities. The wharves and sea wall protection are sensitive to change in splash zone and accelerated degradation of asset condition increasing potential failure of assets during storm events.	10		3	The landside assets have a low adaptive capacity to manage flooding and inundation once higher tides regularly fill drainage capacity of site increasing extent, depth and duration of flooding. Components of wharf assets such as under deck cabling has low adaptive capacity as splash zone rises but structural condition and usability of wharf is likely to cope with up to at least 50 cm SLR due to existing designs incorporating tidal rhythms.	17

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Economic and Infrastructure	Business and Industry	Yes				Yes	Yes			Effective operation of port facilities	Port facilities	Heat wave increase frequency and intensity	5	4 - Moderate to High	4	Moderate sensitivity to increased temperature in regard to refrigerated containers and energy security during heatwaves. Terminal hard surfaces such as bitumen is less sensitive being designed for heavy loading and high traffic,. (temperature impacts to workers is a potential sensitivity that could halt productivity as work practices Act requires tools down at 38-C, therefore if air conditioners on container cranes fails then big issue).	9		7	Significant work procedures to address power failure and safety of workers. The financial resources and recovery capacity of the port and stevedores is very high. Financial loss from port down time is very high which supports high quality maintenance regime. Back-up power for refrigerated containers likely for at least 24 hour period.	12
Economic and Infrastructure	Water / Engineering					Yes				Effective operation of potable water supply (e.g. pipes and pumps) and treatment plants	Potable water supply infrastructure	Rainfall reduction: winter-spring	5	4 - Moderate to High	4	Damage to underground infrastructure as result of soil heavage caused by changes in soil moisture	9	SA Water asset management plans	3		16
Economic and Infrastructure	Water / Engineering					Yes				Effective operation of potable water supply (e.g. pipes and pumps) and treatment plants	Potable water supply infrastructure	Sea level rise	5	3 - Moderate	3	Damage to underground infrastructure as result of sea water intrusion, changes in soil condition with subsequent impacts on potable water supply	8	SA Water asset management plans	2		16
Economic and Infrastructure	Water / Engineering					Yes				Effective operation of potable water supply (e.g. pipes and pumps) and treatment plants	Potable water supply infrastructure	Rainfall reduction: summer-autumn	2	3 - Moderate	3	Damage to underground infrastructure as result of soil heavage caused by changes in soil moisture	5	SA Water asset management plans	3	There is limited capacity in the existing infrastructure	12
Economic and Infrastructure	Buildings and Infrastructure					Yes		Yes		Effective operation of public buildings (incl. Schools, libraries, hospitals)	Schools and libraries - building and contents	Sea level rise	5	4 - Moderate to High	4	Sensitive as result of the role in the community and contents	9	Council and State government assets (schools etc) may have asset management plans, private buildings may have insurance but only larger organisations / industries likely to be considering climate change	5	More older buildings, lower floor levels, less likely to have undertaken emergency planning as hospitals	14
Economic and Infrastructure	Buildings and Infrastructure					Yes		Yes		Effective operation of public buildings (incl. Schools, libraries, hospitals)	Schools and libraries - building and contents	Rainfall intensity increase	5	3 - Moderate	3	Flooding impacts on building structure, maintenance and access	8	Council and State government assets (schools etc) may have asset management plans, private buildings may have insurance but only larger organisations / industries likely to be considering climate change	5	More older buildings, lower floor levels, less likely to have undertaken emergency planning as hospitals	13
Economic and Infrastructure	Buildings and Infrastructure					Yes		Yes		Effective operation of public buildings (incl. Schools, libraries, hospitals)	Hospitals and heath care facilities (including residential aged care) - building and contents	Rainfall reduction: winter-spring	5	2 - Low to Moderate	2	Older buildings could be at risk of soil heavage as reduced soil moisture	7	Council and State government assets (schools etc) may have asset management plans, private buildings may have insurance but only larger organisations / industries likely to be considering climate change	4	In clay soils, more cracking potential New buildings designed for soil movement	13
Economic and Infrastructure	Buildings and Infrastructure					Yes		Yes		Effective operation of public buildings (incl. Schools, libraries, hospitals)	Schools and libraries - building and contents	Rainfall reduction: winter-spring	5	2 - Low to Moderate	2	Older buildings could be at risk of soil heavage as reduced soil moisture	7	Council and State government assets (schools etc) may have asset management plans, private buildings may have insurance but only larger organisations / industries likely to be considering climate change	4	Maintenance issue Older buildings on bluestone buildings more sensitive, buildings constructed on fill may be more sensitive	13
Economic and Infrastructure	Buildings and Infrastructure					Yes		Yes		Effective operation of public buildings (incl. Schools, libraries, hospitals)	Hospitals and heath care facilities (including residential aged care) - building and contents	Rainfall intensity increase	5	4 - Moderate to High	4	Sensitive to flooding as result of the role in the community and contents access issues following intense rain events	9	Council and State government assets (schools etc) may have asset management plans, private buildings may have insurance but only larger organisations / industries likely to be considering climate change	7	SMPs may consider some access issues for QEH All major health facilities would have emergency response plans. Many health facilities newer and better design and more robust construction Access to facilities likely to be biggest issue, SMPs play a key role Roof design and age of building, maintenance will influence damage to contents for older buildings Scored for buildings (not access)	12
Economic and Infrastructure	Buildings and Infrastructure					Yes		Yes		Effective operation of public buildings (incl. Schools, libraries, hospitals)	Hospitals and heath care facilities - building and contents	Sea level rise	5	4 - Moderate to High	4	Sensitive as result of the role in the community and facilities contained within	9	Council and State government assets (schools etc) may have asset management plans, private buildings may have insurance but only larger organisations / industries likely to be considering climate change	7	SMPs may consider some access issues for QEH All major health facilities would have emergency response plans. Many health facilities newer and better design and more robust construction Access to facilities likely to be biggest issue, SMPs play a key role Roof design and age of building, maintenance will influence damage to contents for older buildings Scored for buildings (not access)	12
Economic and Infrastructure	Buildings and Infrastructure					Yes		Yes		Effective operation of public buildings (incl. Schools, libraries, hospitals)	Hospitals and heath care facilities (including residential aged care) - building and contents	Heat wave increase frequency and intensity	5	1 - Low	1	Low sensitivity to heat wave. People and electricity supply (considered in other indicators) are sensitive aspects	6	Council and State government assets (schools etc) may have asset management plans, private buildings may have insurance but only larger organisations / industries likely to be considering climate change	8	Buildings have high AC but people and electricity (considered elsewhere) have lower AC	8
Economic and Infrastructure	Buildings and Infrastructure					Yes		Yes		Effective operation of public buildings (incl. Schools, libraries, hospitals)	Schools and libraries - building and contents	Heat wave increase frequency and intensity	5	1 - Low	1	Low sensitivity to heat wave. People and electricity supply (considered in other indicators) are sensitive aspects	6	Council and State government assets (schools etc) may have asset management plans, private buildings may have insurance but only larger organisations / industries likely to be considering climate change	8	Buildings have high AC but people and electricity (considered elsewhere) have lower AC	8

Grouping	Subgroup	Coastal Environment	Biodiversity	Coastal and Riverine WQ	Stormwater	Infrastructure and Essential Services	Productivity and economy	Community	Amenity and Quality of Life	Indicator /s	Feature to score	Exposure (Climate Variable)	Exposure Score	Sensitivity to Climate Variable	Sensitivity Score	Comment	Potential Impact	Comment on Adaptive Capacity from Research Papers	Adaptive Capacity Score	Adaptive Capacity Workshop Comment	Vulnerability Score
Economic and Infrastructure	Buildings and Infrastructure					Yes				Effective operation of rail network	Rail infrastructure	Sea level rise	5	5 - High	5	Bridges and embankment stability sensitive to slr, salt water impact on soil stability and infrastructure	10		3		17
Economic and Infrastructure	Buildings and Infrastructure					Yes				Effective operation of rail network	Rail infrastructure	Heat wave increase frequency and intensity	5	4 - Moderate to High	4	Buckling of rail lines in extreme has been seen in recent heatwaves	9	DPTI Extreme Heat Transport Plan identifies changes in number of services to allow management of heat related infrastructure failures	3	Might be able to transport by road, buses for public transport, massive flow on impacts of interruptions to rail lines to Port / OH (supply chain etc), changes in train line tensioning can be response, unseasonal heat waves when not ready to respond may cause more failure, wood rail lines replaced with concrete provides better expansion / contraction. Signals failure Recent heat waves have seen disturbance and failures CHECK AC ASSUMPTIONS THAT CURRENT SYSTEM ABLE TO COPE	16
Economic and Infrastructure	Buildings and Infrastructure					Yes				Effective operation of rail network	Rail infrastructure	Rainfall intensity increase	5	3 - Moderate	3	Short term damage to rail infrastructure including culverts and track foundations, potential interruptions to signals and other infrastructure	8	Stormwater management plans, infrastructure design and upgrades	3	Signal failure in 2014 caused disruption, close crossings	15
Economic and Infrastructure	Buildings and Infrastructure				Yes	Yes				Effective operation of road network	Road infrastructure	Heat wave increase frequency and intensity	5	4 - Moderate to High	4	Impact of heat on bitumen	9	Can put crushed rock on road to protect bitumen	2	Council asset management plans not currently considering CC impacts and need for alternative surfaces Better performing surface materials available but not currently standard, Climate change not high on agenda of capital works programs, historic programs of works and maintenance entrenched in Council culture Education, awareness etc could play role in change	17
Economic and Infrastructure	Buildings and Infrastructure				Yes	Yes				Effective operation of road network	Road infrastructure	Sea level rise	5	4 - Moderate to High	4	Road base and foundation at risk from coastal erosion, changes in soil structure and potential for sink holes and erosion, requirement to divert traffic to minor roads	9	Stormwater management plans	2		17
Economic and Infrastructure	Buildings and Infrastructure				Yes	Yes				Effective operation of road network	Road infrastructure	Rainfall intensity increase	5	3 - Moderate	3	Minor roads act as stormwater drainage, sensitive to increased flows	8	Stormwater management plans	2	Design capacity may not be adequate to cope with increased runoff	16
Economic and Infrastructure	Business and Industry					Yes	Yes			Effective operation of telecommunications infrastructure	Telecommunications infrastructure	Heat wave increase frequency and intensity	5	4 - Moderate to High	4	High temperatures inside exchanges impacts operations, increased demand for services during heat waves places stress on system	9	Cooling for exchanges	5	Air-conditioning of exchanges can be undertaken but effectiveness could be impacted by disruptions to power, Ability to maintain communication by using mobile phones rather than land lines, broadband underground protected, some internet service providers already considering extreme heat impacts on operations	14
Economic and Infrastructure	Business and Industry					Yes	Yes			Effective operation of telecommunications infrastructure	Telecommunications infrastructure	Rainfall intensity increase	5	3 - Moderate	3	Operations could be disrupted by inundation	8		5	Telecommunications infrastructure is likely to survive short term periods of inundation with current management responses.	13
Economic and Infrastructure	Business and Industry					Yes	Yes			Effective operation of telecommunications infrastructure	Telecommunications infrastructure	Sea level rise	5	2 - Low to Moderate	2	Operations could be disrupted by inundation, Underground cabling may be impacted by saline water	7		5	Underground telecommunications assets relatively new (eg broadband) and more likely to be designed to withstand impacts	12
Economic and Infrastructure	Water / Engineering					Yes				Effective operation of wastewater treatment systems (e.g. pipes, plant, distribution etc.)	Wastewater treatment infrastructure	Rainfall intensity increase	5	4 - 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	9	SA Water asset management plans	3	Sewer system is already struggling with stormwater incursion.	16
Economic and Infrastructure	Water / Engineering					Yes				Effective operation of wastewater treatment systems (e.g. pipes, plant, distribution etc.)	Wastewater treatment infrastructure	Rainfall reduction: winter-spring	5	3 - Moderate	3	Damage to underground infrastructure as result of soil heavage caused by changes in soil moisture	8	SA Water asset management plans	5	Discussed but not scored - MS has assigned score of 5 based on discussion	13
Economic and Infrastructure	Water / Engineering					Yes				Effective operation of wastewater treatment systems (e.g. pipes, plant, distribution etc.)	Wastewater treatment infrastructure	Sea level rise	5	3 - Moderate	3	Damage to underground infrastructure, Glenelg WWTP flooding could cause disruption to treatment processes	8	SA Water asset management plans	5	Discussed but not scored - MS has assigned score of 5 based on discussion	13
Economic and Infrastructure	Water / Engineering					Yes				Effective operation of wastewater treatment systems (e.g. pipes, plant, distribution etc.)	Wastewater treatment infrastructure	Rainfall reduction: summer-autumn	2	3 - Moderate	3	Damage to underground infrastructure as result of soil heavage caused by changes in soil moisture	5	SA Water asset management plans	5	Discussed but not scored - MS has assigned score of 5 based on discussion	10
Social	Support services							Yes		Employment by key sectors	Health and community services sector	Sea level rise	5	4 - Moderate to High	4	May require building / facility changes or relocation, resulting in increased costs and possibly require changes in employment	9		2	Existing design standards and building code etc	17
Social	Support services							Yes		Employment by key sectors	Manufacturing sector	Sea level rise	5	4 - Moderate to High	4	May require building / facility changes or relocation, resulting in increased costs and possibly require changes in employment	9		2	Port area particularly vulnerable, Impact transportation of goods impacted by inundation, Relocation of manufacturing areas difficult due to lack of alternative cost etc. Limited by zoning	17

Grouping	Subgroup	Coastal Environment	Biodiversity	Coastal and Riverine WQ	Stormwater	Infrastructure and Essential Services	Productivity and economy	Community	Amenity and Quality of Life	Indicator /s	Feature to score	Exposure (Climate Variable)	Exposure Score	Sensitivity to Climate Variable	Sensitivity Score	Comment	Potential Impact	Comment on Adaptive Capacity from Research Papers	Adaptive Capacity Score	Adaptive Capacity Workshop Comment	Vulnerability Score
Social	Support services							Yes		Employment by key sectors	Retail trade sector	Sea level rise	5	4 - Moderate to High	4	May require building / facility changes or relocation, resulting in increased costs and possibly require changes in employment	9		2	Key coastal hubs eg Semaphore etc will be impacted	17
Social	Support services							Yes		Employment by key sectors	Health and community services sector	Heat wave increase frequency and intensity	5	4 - 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		4	Often office based, but do significant outreach work. Policies that restrict visitation during extreme events. Increased presentations at hospitals and other services. Restricted opportunity to expand sector as often government funded. Culture of sector is to help others and respond to need. Significant volunteer involvement in sector which may be impacted if helping others during extreme event	15
Social	Support services							Yes		Employment by key sectors	Manufacturing sector	Heat wave increase frequency and intensity	5	4 - Moderate to High	4	Will impact productivity of workers and machinery. Workers will be impacted where workshops are not air-conditioned, could have implications for employment levels as working conditions change	9		4	Some workplaces will be cooled. May start earlier in day. Power outages can occur and disrupt operations.	15
Social	Support services							Yes		Employment by key sectors	Manufacturing sector	Rainfall intensity increase	5	2 - Low to Moderate	2	Flood water impacts with surface water disrupt access, supply chain and operations in short term, not likely to result in much change in employment	7		2	Flooding prevents access ie to get to work due to flooding of roads or building itself, flooding and damage to buildings. Stormwater management. Temporary issue but could be over extended period in some localities. Possible damage to stock and equipment. Is private sector so others will go elsewhere for products and services. May not be insured or adequately insured. Often don't have a lot of contingency for downtime	15
Social	Support services							Yes		Employment by key sectors	Retail trade sector	Rainfall intensity increase	5	2 - Low to Moderate	2	Periodic restricted access to shops may have minor impact on trade, unlikely to result in much change in employment	7		2	Flooding prevents access ie to get to work due to flooding of roads or building itself, flooding and damage to buildings. Stormwater management. Temporary issue but could be over extended period in some localities Possible damage to stock and equipment. Private sector so others will go elsewhere for products and services. May not be insured or adequately insured. Often don't have a lot of contingency for downtime	15
Social	Support services							Yes		Employment by key sectors	Health and community services sector	Rainfall intensity increase	5	4 - 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		5	Flooding prevents access ie to get to work due to flooding of roads or building itself, flooding and damage to buildings. Stormwater management. Temporary issue but could be over extended period in some localities	14
Social	Support services							Yes		Employment by key sectors	Retail trade sector	Heat wave increase frequency and intensity	5	3 - Moderate	3	People are less likely to spend time in small shops (ie in malls or streets without air-conditioning). More people may go to large regional shopping centres (e.g. West Lakes) so employment may change over time.	8		8	Often have air conditioning Power outages can occur and disrupt operations, some bigger centres will have auxiliary plants. May generate increased business and employment as more people visit and use facilities during extreme heat to stay cool	10
Economic and Infrastructure	Water / Engineering						Yes			Groundwater quantity and quality (for use by industry)	Groundwater quantity and quality	Rainfall reduction: winter-spring	5	2 - Low to Moderate	2	Recharge (although outside the Region) is highly sensitive to reductions in winter - spring rainfall	7	Water Allocation Plan	2		15
Social	Support services								Yes	Incidence of anti-social behaviour	Incidence of anti-social behaviour	Heat wave increase frequency and intensity	5	4 - Moderate to High	4	Increased gatherings of people at the beach on warm days and nights is understood to lead to higher levels of anti-social behaviour, related to higher levels of stress due to levels of heat, greater alcohol consumption and lack of sleep.	9		2	Dry Zones along beaches. Aggressive behaviour in pubs, clubs etc. More outdoor gatherings, increased drinking. Police call outs re noise interruptions to neighbours. Heat interfere with medication, mental health issues, irritability, lack of health etc	17
Social	Support services								Yes	Incidence of social behaviour- Neighbourly interactions	Neighbourly interactions	Heat wave increase frequency and intensity	5	5 - High	5	Often interactions occur outside, in public open spaces, over the fence etc. Less opportunity to occur during extreme events. Less opportunity for incidences to occur. People are very busy, limited time to interact	10		2		18
Social	Support services								Yes	Incidence of social behaviour- Neighbourly interactions	Neighbourly interactions	Rainfall intensity incre	5	5 - High	5	Often interactions occur outside, in public open spaces, over the fence etc. Less opportunity to occur during extreme events. Less opportunity for incidences to occur. People are very busy, limited time to interact	10		4	Localised events can increase interactions as people come together in a crisis. Causes people to be outside, assessing and fixing damage	16
Social	Support services					Yes		Yes		Interruption to public transport services	Public transport	Sea level rise	5	3 - Moderate	3	Disruption to routes, short term interruption	8		2		16
Social	Support services					Yes		Yes		Interruption to public transport services	Public transport	Heat wave increase frequency and intensity	5	5 - High	5	Rail lines buckle, buses without adequate air-conditioning not suitable for passengers or drivers, changes to scheduling	10	DPTI Extreme Heat Transport Plan identifies changes in number of services to allow management of heat related infrastructure failures	5	If trains are disrupted, buses are put on routes. Waiting times may extend during disruption. Some bus shelters. Significant use of trains in region. Main issue relates to reduced use of public transport during extreme events	15
Social	Support services									Interruption to public transport services	Public transport	Rainfall intensity increase	5	3 - Moderate	3	Disruption to routes, short term interruption	8	Route alterations	6	Re route scheduled bus route if flooded. Main issue relates to reduced use of public transport during extreme events	12

Grouping	Subgroup	Coastal Environment	Biodiversity	Coastal and Riverine WQ	Stormwater	Infrastructure and Essential Services	Productivity and economy	Community	Amenity and Quality of Life	Indicator /s	Feature to score	Exposure (Climate Variable)	Exposure Score	Sensitivity to Climate Variable	Sensitivity Score	Comment	Potential Impact	Comment on Adaptive Capacity from Research Papers	Adaptive Capacity Score	Adaptive Capacity Workshop Comment	Vulnerability Score
Social	Support services							Yes		Level of support from family, friends and neighbours	Level of support from family, friends and neighbours	Sea level rise	5	4 - Moderate to High	4	Support may be reduced or not available as family, friends and neighbours work to address their own inundation issues. People may chose to relocate to areas less likely to be inundated, thereby reducing their capacity to be close and assist during times of need.	9		5	Assumes availability of support outside the immediate impact area, so that not all of an individuals support network is affected by extreme event at any time, disruption to essential services and transport could limit capacity	14
Social	Support services							Yes		Level of support from family, friends and neighbours	Level of support from family, friends and neighbours	Heat wave increase frequency and intensity	5	3 - Moderate	3	People may be less willing to leave the house during heat waves to assist others.	8		6	Affects a wider proportion of the community so could be larger demand for alternate support services. Services in place however already isolated people have less people to support them. Weather forecasts can help by identifying in advance when preparation is required.	12
Social	Support services							Yes		Level of support from family, friends and neighbours	Level of support from family, friends and neighbours	Rainfall intensity increase	5	4 - Moderate to High	4	Support may be reduced or not available as family, friends and neighbours work to address their own inundation issues. People may chose to relocate to areas less likely to be inundated, thereby reducing their capacity to be close and assist during times of need.	9		7	Assumes availability of support outside the immediate impact area, so that not all of an individuals support network is affected by extreme event at any time, disruption to essential services and transport could limit capacity	12
Social	Vulnerable communities							Yes		Members of the community living in public housing	Members of the community living in public housing	Heat wave increase frequency and intensity	5	5 - High	5	Households without air-conditioning in their houses or concerned about cost of operating air-conditioners more sensitive, houses often have less green areas outside due to cost of maintaining and irrigating	10	Community service organisations provide assistance eg phone calls to check preparations for hot days, delivery of groceries	3	Limited A/C in public housing. Design standards are poorer.	17
Social	Vulnerable communities							Yes		Members of the community living in public housing	Members of the community living in public housing	Sea level rise	5	5 - High	5	People reliant on public housing sensitive as may not have resources to address inundation in short term. In longer term, relocation may be required and demand for housing may increase placing increased pressure on those living in public housing.	10		6	Landlord is responsible for mitigating the effects of flooding/SLR	14
Social	Vulnerable communities							Yes		Members of the community living in public housing	Members of the community living in public housing	Rainfall intensity increase	5	4 - Moderate to High	4	Those in public housing sensitive to damage or destruction or insurance of property as don't have resources to repair or replace and have to rely on Housing SA.	9		6	Landlord is responsible for mitigating the effects of flooding/SLR	13
Social	Vulnerable communities							Yes		Members of the community living in public housing	Members of the community living in public housing	Temperature increase	5	3 - Moderate	3	Less need for heating in winter as temperatures increase.	8		6		12
Social	Vulnerable communities							Yes	Yes	Members of the community living with mental health problems	Members of the community living with mental health problems	Heat wave increase frequency and intensity	5	5 - High	5	Heat is a stressor and is in the literature re change in behaviour (including domestic violence) as a result of heat stress. Being a recluse, mental disorder etc. also potentially exacerbated.	10	Community service organisations provide assistance eg phone calls to check preparations for hot days, delivery of groceries	2	Medication does not let you sweat. Cognitive capability is low. Greater susceptibility to mortality in heatwaves. Funding for mental health services is low compared to demand	18
Social	Vulnerable communities							Yes	Yes	Members of the community living with mental health problems	Members of the community living with mental health problems	Sea level rise	5	5 - High	5	People with mental health issues may be more sensitive to impacts of property destruction as result of coastal inundation	10		5	Medication does not let you sweat. Cognitive capability is low. Greater susceptibility to mortality in heatwaves. Funding for mental health services is low compared to demand	15
Social	Vulnerable communities							Yes	Yes	Members of the community living with mental health problems	Members of the community living with mental health problems	Rainfall intensity increase	5	4 - Moderate to High	4	People with mental health issues may be more sensitive to impacts of property destruction as result of flooding	9		5	Medication does not let you sweat. Cognitive capability is low. Greater susceptibility to mortality in heatwaves. Funding for mental health services is low compared to demand	14
Social	Vulnerable communities							Yes		Members of the community under financial stress	Members of the community under financial stress	Heat wave increase frequency and intensity	5	5 - High	5	Households without air-conditioning in their houses or concerned about cost of operating air-conditioners more sensitive, houses often have less green areas outside due to cost of maintaining and irrigating	10	Community service organisations provide assistance eg phone calls to check preparations for hot days, delivery of groceries	3	People living alone with no community health services or private health care had greater mortality. People in rental properties may find it difficult to install A/C. Responsibility for landlords for rental housing is important. Lack of pensioner concession will create greater stress	17
Social	Vulnerable communities							Yes		Members of the community under financial stress	Members of the community under financial stress	Sea level rise	5	4 - Moderate to High	4	Those under financial stress very sensitive to damage or destruction or insurance of property as don't have resources to repair or replace	9		3		16
Social	Vulnerable communities							Yes		Members of the community under financial stress	Members of the community under financial stress	Rainfall intensity increase	5	4 - Moderate to High	4	Those under financial stress very sensitive to damage or destruction or insurance of property as don't have resources to repair or replace	9		4	Often not insured in rental housing	15
Social	Vulnerable communities							Yes		Members of the community under financial stress	Members of the community under financial stress	Temperature increase	5	3 - Moderate	3	Less need for heating in winter as temperatures increase.	8		6		12
Social	Vulnerable communities							Yes		Members of the community who require assistance for core activities	Members of the community who require assistance for core activities	Sea level rise	5	5 - High	5	Support services for core activities may not be available during periods of inundation. Higher sensitivity than other vulnerable groups as this indicator relates to those who may be physically unable to assist themselves.	10		1	Restricted mobility is a key issue. Main variable is access to a good care attendant	19
Social	Vulnerable communities							Yes		Members of the community who require assistance for core activities	Members of the community who require assistance for core activities	Heat wave increase frequency and intensity	5	5 - High	5	Support services for core activities may not be available during extreme events for extended periods (>24 hours).	10	Community service organisations provide assistance eg phone calls to check preparations for hot days, delivery of groceries	2	Restricted mobility is a key issue. Main variable is access to a good care attendant	18

Grouping	Subgroup	Coastal Environment	Biodiversity	Coastal and Riverine WQ	Stormwater	Infrastructure and Essential Services	Productivity and economy	Community	Anenity and Quality of Life	Indicator /s	Feature to score	Exposure (Climate Variable)	Exposure Score	Sensitivity to Climate Variable	Sensitivity Score	Comment	Potential Impact	Comment on Adaptive Capacity from Research Papers	Adaptive Capacity Score	Adaptive Capacity Workshop Comment	Vulnerability Score
Social	Vulnerable communities							Yes		Members of the community who require assistance for core activities	Members of the community who require assistance for core activities	Rainfall intensity increase	5	5 - 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.	10		2	Restricted mobility is a key issue. Main variable is access to a good care attendant	18
Social	Vulnerable communities							Yes	Yes	Members of the community with poor self-assessed health	Members of the community with poor self-assessed health	Heat wave increase frequency and intensity	5	5 - High	5	Those with existing medical conditions likely to be very sensitive to heatwaves. Dehydration can cause adverse impacts to those on medications. Some people may be relying on electricity to run medical equipment	10	Community service organisations provide assistance eg phone calls to check preparations for hot days, delivery of groceries	2	When have multiple chronic issues there can be rapid impact of heat wave	18
Social	Vulnerable communities							Yes	Yes	Members of the community with poor self-assessed health	Members of the community with poor self-assessed health	Sea level rise	5	4 - Moderate to High	4	Those with existing medical conditions, limited mobility or reliance on support from others likely to be sensitive to increased inundation	9		4	There are many options but can the people impacted assist themselves?	15
Social	Vulnerable communities							Yes	Yes	Members of the community with poor self-assessed health	Members of the community with poor self-assessed health	Rainfall intensity increase	5	4 - Moderate to High	4	Those with existing medical conditions, limited mobility or reliance on support from others likely to be sensitive to increased rain intensity	9		7		12
Social	Vulnerable communities							Yes	Yes	Members of the community with poor self-assessed health	Members of the community with poor self-assessed health	Temperature increase	5	3 - Moderate	3	Many people likely to be sensitive to increasing temperatures	8		6	Pollens and dust could exacerbate existing conditions. Low confidence in underpinning information to make an assessment	12
Social	Vulnerable communities							Yes		Older members of the community (aged >75)	Older members of the community	Sea level rise	5	5 - High	5	Older people are highly sensitive because of mobility issues, pre-existing illness and poorer health in general.	10		2	Less likely to be able to move - income, less desire	18
Social	Vulnerable communities							Yes		Older members of the community (aged >75)	Older members of the community	Heat wave increase frequency and intensity	5	5 - High	5	Older people are highly sensitive because of mobility issues, pre-existing illness and poorer health in general.	10	Community service organisations provide assistance eg phone calls to check preparations for hot days, delivery of groceries, Red Cross telelink service	3	Community transport can move people through the community	17
Social	Vulnerable communities							Yes		Older members of the community (aged >75)	Older members of the community	Rainfall intensity increase	5	4 - Moderate to High	4	Older people are highly sensitive because of mobility issues, pre-existing illness and poorer health in general.	9		4	More likely to be home but lower ability to move sandbags	15
Social	Vulnerable communities							Yes		Older members of the community (aged >75)	Older members of the community	Temperature increase	5	4 - Moderate to High	4	Less need for heating in winter as temperatures increase.	9		7	Harder to adapt to dust and pollens and emerging diseases	12
Social	Community events and activities							Yes		Participation in organised sport, church or community group in local area	Participation levels	Sea level rise	5	5 - High	5	SLSC, Coastcare and Waterwatch sensitive as without beaches or coastal areas their activities are restricted.	10		3	Limited capacity to move sporting grounds in affected areas. Greater capacity to move church	17
Social	Community events and activities							Yes		Participation in organised sport, church or community group in local area	Participation levels	Heat wave increase frequency and intensity	5	5 - High	5	Sports participation restricted by extreme heat, older people highly sensitive	10		4	Given current circumstances, very limited. Best option is rescheduling but this may not always be possible	16
Social	Community events and activities							Yes		Participation in organised sport, church or community group in local area	Participation levels	Temperature increase: summer - autumn	4	3 - Moderate	3	More hot days overall makes conditions less suitable for outdoor activities	7		6		11
Social	Community events and activities							Yes		Participation in organised sport, church or community group in local area	Participation levels	Rainfall intensity increase	5	3 - Moderate	3	Participants may not wish to leave home during extreme rain or storms	8		8	Stormwater management plans are already in place that can assist	10
Social	Community events and activities							Yes		Participation in organised sport, church or community group in local area	Participation levels	Temperature increase: winter - spring	5	2 - Low to Moderate	2	Participants possibly to be sensitive to increased temperature, could be potential for increased participation in winter	7		8		9
Economic and Infrastructure	Business and Industry						Yes			Potential for future industrial development	Gillman development area	Sea level rise	5	5 - High	5	Development would be sensitive to sea water inundation - no development will occur to land under water	10	Planning and investigations for sea wall, development will need to occur well above natural ground level	1	Knowledge exists about risks of slr but no action currently in place or funded to enable development of site, site opportunity can not retreat	19
Economic and Infrastructure	Business and Industry						Yes			Potential for future industrial development	Gillman development area	Rainfall intensity increase	5	3 - Moderate	3	Surface flooding from HEP catchment	8	Stormwater management plans, constructed wetlands, development will need to occur well above natural ground level	1	Knowledge exists about risks of slr but no action currently in place or funded to enable development of site, site opportunity can not retreat	17
Environment	Coast, marine and aquatic	Yes		Yes					Yes	Quality of water – coastal/estuaries	Port River	Sea level rise	5	4 - Moderate to High	4	SLR induced coastal inundation could result in pollutants being washed out and water quality impact, impact on underground assets, could also change salinity	9		1	Limited action currently	18
Environment	Coast, marine and aquatic	Yes		Yes					Yes	Quality of water – coastal/estuaries	Barker Inlet/Lipson Reach	Sea level rise	5	3 - Moderate	3	SLR induced coastal inundation could result in pollutants being washed out and water quality impact, impact on underground assets, could also change salinity	8		1	Groundwater impacts Water Allocation Plan EPA pollution clean up requirements PASS issues	17
Environment	Coast, marine and aquatic	Yes		Yes					Yes	Quality of water – coastal/estuaries	Barker Inlet/Lipson Reach	Sea surface temperature increase	5	3 - Moderate	3	Changes to nutrient cycling and primary productivity, less mixing / dilution effect than in Gulf waters so more sensitive	8	Stormwater management plans, constructed wetlands, catchment management programs	1	Limited by lack of knowledge about potential for action	17
Environment	Coast, marine and aquatic	Yes		Yes					Yes	Quality of water – coastal/estuaries	Port River	Sea surface temperature increase	5	3 - Moderate	3	Changes to nutrient cycling and primary productivity, less mixing / dilution effect than in Gulf waters so more sensitive	8		1		17

Grouping	Subgroup	Coastal Environment	Biodiversity	Coastal and Riverine WQ	Stormwater	Infrastructure and Essential Services	Productivity and economy	Community	Attenity and Quality of Life	Indicator /s	Feature to score	Exposure (Climate Variable)	Exposure Score	Sensitivity to Climate Variable	Sensitivity Score	Comment	Potential Impact	Comment on Adaptive Capacity from Research Papers	Adaptive Capacity Score	Adaptive Capacity Workshop Comment	Vulnerability Score
Environment	Coast, marine and aquatic	Yes		Yes					Yes	Quality of water – coastal/estuaries	Port River	Rainfall intensity increase	5	3 - Moderate	3	Short term impacts from discharge of polluted stormwater	8	Stormwater management plans, constructed wetlands, catchment management programs	2	Fewer SMPs	16
Environment	Coast, marine and aquatic	Yes		Yes					Yes	Quality of water – coastal/estuaries	Gulf waters	Sea surface temperature increase	5	2 - Low to Moderate	2	Changes to nutrient cycling and primary productivity, greater mixing / dilution effect in Gulf waters	7		1		16
Environment	Coast, marine and aquatic	Yes		Yes					Yes	Quality of water – coastal/estuaries	Barker Inlet/Lipson Reach	Ocean acidity increase	3	3 - Moderate	3	Change pH and CO2, less mixing / dilution effect than in Gulf waters so more sensitive	6		1	Very low confidence as limited knowledge	15
Environment	Coast, marine and aquatic	Yes		Yes					Yes	Quality of water – coastal/estuaries	Gulf waters	Ocean acidity increase	3	3 - Moderate	3	Change pH and CO2	6	Stormwater management plans, constructed wetlands, catchment management programs	1	Very low confidence as limited knowledge	15
Environment	Coast, marine and aquatic	Yes		Yes					Yes	Quality of water – coastal/estuaries	Port River	Ocean acidity increase	3	3 - Moderate	3	Change pH and CO2, less mixing / dilution effect and potential concentration with high evaporation than in Gulf waters so more sensitive	6		1	Very low confidence as limited knowledge	15
Environment	Coast, marine and aquatic	Yes		Yes					Yes	Quality of water – coastal/estuaries	Barker Inlet/Lipson Reach	Rainfall intensity increase	5	3 - Moderate	3	Short term impacts from discharge of polluted stormwater, much greater catchment areas than Gulf waters and Port River so likely higher pollutant load.	8		3	Gillman wetlands provide water quality improvement Stormwater management plans **Question about future of Gillman wetlands if future development occurs PR WQIP Catchment management plans	15
Environment	Coast, marine and aquatic	Yes		Yes					Yes	Quality of water – coastal/estuaries	Gulf waters	Rainfall intensity increase	5	4 - Moderate to High	4	Short term impacts from discharge of polluted stormwater (large Torrens catchment) as well as coastal erosion impacts	9		4	Torrens discharge, sediment Reduced discharge from Glenelg WWTP and no releases from Port WWTP Waterproofing the West	15
Environment	Coast, marine and aquatic	Yes		Yes					Yes	Quality of water – coastal/estuaries	Gulf waters	Sea level rise	5	1 - Low	1	Erosion that may occur as result of SLR not likely to have major impact on water quality	6		1		15
Environment	Coast, marine and aquatic		Yes	Yes						Quality of water - inland waters	West Lakes	Sea Level Rise	5	5 - High	5	Pumping problems to enable flushing of water	10	Stormwater management plans, constructed wetlands, WSUD, catchment management programs	1		19
Environment	Coast, marine and aquatic		Yes	Yes						Quality of water - inland waters	Other watercourses	Temperature increase	5	4 - Moderate to High	4	Increased evaporation and concentration of nutrients, eutrophication and water temperature potential for algal blooms	9	Stormwater management plans, constructed wetlands, WSUD, catchment management programs	2		17
Environment	Coast, marine and aquatic		Yes	Yes						Quality of water - inland waters	River Torrens	Temperature increase	5	4 - Moderate to High	4	Increased evaporation and concentration of nutrients, eutrophication and water temperature potential for algal blooms	9	Stormwater management plans, constructed wetlands, WSUD, catchment management programs	2	Releases for environmental flows prevent algal blooms, Lack of e-flows has more risk of fish kills Reduced impervious areas due to higher density of development may result in higher water temperature of runoff	17
Environment	Coast, marine and aquatic		Yes	Yes						Quality of water - inland waters	West Lakes	Temperature increase	5	4 - Moderate to High	4	Increased evaporation and concentration of nutrients, eutrophication and water temperature potential for algal blooms	9	Stormwater management plans, constructed wetlands, WSUD, catchment management programs	2	Sea water pumping to flush water and change temperature	17
Environment	Coast, marine and aquatic		Yes	Yes						Quality of water - inland waters	River Torrens	Sea Level Rise	5	2 - Low to Moderate	2	Saltwater intrusion may increase salinity	7	Stormwater management plans, constructed wetlands, WSUD, catchment management programs	2	High tide events likely to cause water to back up further upstream Large requirements for pumping stormwater and sea water	15
Environment	Coast, marine and aquatic		Yes	Yes						Quality of water - inland waters	Other watercourses	Rainfall intensity increase	5	3 - Moderate	3	Increase in pollutant load from highly developed catchments	8	Stormwater management plans, constructed wetlands, WSUD, catchment management programs	4	Stormwater management plans, stormwater treatment infrastructure (WSUD, wetlands, etc), infrastructure design decisions re capacity and sizing, planning policy (area of impervious, on-site capture and storage Dry Creek potential increase flows from high intensity events	14
Environment	Coast, marine and aquatic		Yes	Yes						Quality of water - inland waters	River Torrens	Rainfall intensity increase	5	4 - Moderate to High	4	Increase in pollutant load from highly developed large catchment, more environmental values associated with watercourse	9	Stormwater management plans, constructed wetlands, WSUD, catchment management programs	6	Stormwater management plans, stormwater treatment infrastructure (WSUD, wetlands, etc), catchment management upstream, infrastructure design decisions re capacity and sizing, planning policy (area of impervious, on-site capture and storage), WQIP, Waterproofing the West Environmental flow as releases from algal management at Torrens Lake, Breakout Creek wetlands	13
Environment	Coast, marine and aquatic		Yes	Yes						Quality of water - inland waters	West Lakes	Rainfall intensity increase	5	3 - Moderate	3	Increase in pollutant load from highly developed catchment	8	Stormwater management plans, constructed wetlands, WSUD, catchment management programs	5	Kirkaldy Creek Sea water input at High tide	13
Economic and Infrastructure	Water / Engineering	Yes		Yes	Yes					Quantity of stormwater generated	Quantity of stormwater	Rainfall intensity increase	5	4 - Moderate to High	4	More flash events during summer when low infiltration, highly impervious catchment and future increase in housing density	9	Stormwater management plans, constructed wetlands, WSUD, catchment management programs	5	Working with today's level of hard surfaces (as opposed to increasing densification of housing)	14
Economic and Infrastructure	Water / Engineering	Yes		Yes	Yes					Quantity of stormwater generated	Quantity of stormwater	Rainfall reduction: winter-spring	5	4 - Moderate to High	4	More flash events during summer when low infiltration, highly impervious catchment and future increase in housing density	9	Stormwater management plans, constructed wetlands, WSUD, catchment management programs	5	Working with today's level of hard surfaces (as opposed to increasing densification of housing)	14

Grouping	Subgroup	Coastal Environment	Biodiversity	Coastal and Riverine WQ	Stormwater	Infrastructure and Essential Services	Productivity and economy	Community	Amenity and Quality of Life	Indicator /s	Feature to score	Exposure (Climate Variable)	Exposure Score	Sensitivity to Climate Variable	Sensitivity Score	Comment	Potential Impact	Comment on Adaptive Capacity from Research Papers	Adaptive Capacity Score	Adaptive Capacity Workshop Comment	Vulnerability Score
Social	Support services							Yes		Rates of volunteerism in organised support groups (e.g. SLSC, Meals on Wheels, service clubs, SES)	Volunteering rates	Sea level rise	5	4 - Moderate to High	4	Support may be reduced or not available as family, friends and neighbours work to address their own inundation issues. People may chose to relocate to areas less likely to be inundated, thereby reducing their capacity to be close and assist during times of need.	9		3	NOT SCORED AT WORKSHOP - GROUP VIEW WAS THAT IT WAS SIMILAR TO PARTICIPATION IN SPORTING, CHURCH GROUPS ETC.	16
Social	Support services							Yes		Rates of volunteerism in organised support groups (e.g. SLSC, Meals on Wheels, service clubs, SES)	Volunteering rates	Heat wave increase frequency and intensity	5	4 - Moderate to High	4	Heatwaves makes conditions less suitable for volunteering over short term. Possible to be sensitive to overall rates of volunteering	9		4	NOT SCORED AT WORKSHOP - GROUP VIEW WAS THAT IT WAS SIMILAR TO PARTICIPATION IN SPORTING, CHURCH GROUPS ETC.	15
Social	Support services							Yes		Rates of volunteerism in organised support groups (e.g. SLSC, Meals on Wheels, service clubs, SES)	Volunteering rates	Rainfall intensity increase	5	4 - Moderate to High	4	Support may be reduced or not available as family, friends and neighbours work to address their own inundation issues. People may chose to relocate to areas less likely to be inundated, thereby reducing their capacity to be close and assist during times of need.	9		8	NOT SCORED AT WORKSHOP - GROUP VIEW WAS THAT IT WAS SIMILAR TO PARTICIPATION IN SPORTING, CHURCH GROUPS ETC.	11
Social	Vulnerable communities							Yes		Younger members of the community (e.g. <12)	Younger members of the community	Sea level rise	5	4 - Moderate to High	4	Children < 12 years are sensitive to extreme events however they are less likely to have existing medical concerns.	9	Sea level rise impacts likely to be managed by parents and carers.	2	Intractable problem. Housing impacts will prove a challenge for financially stressed communities. Young people's adaptive capacity is tied up wit the family group	17
Social	Vulnerable communities							Yes		Younger members of the community (e.g. <12)	Younger members of the community	Heat wave increase frequency and intensity	5	3 - Moderate	3	Children < 12 years are sensitive to extreme events however they are less likely to have existing medical concerns. Children sensitive to dehydration.	8	School and sports organisation hot weather policies, parents/carers likely to manage young children's activity during heat waves	6	Management of children under 12 is different than those over 12 (high school children). Individual Councils may struggle to meet changing need for programs and facilities. School provides a mechanism to adapt for change.	12
Social	Vulnerable communities							Yes		Younger members of the community (e.g. <12)	Younger members of the community	Rainfall intensity increase	5	1 - Low	1	Children < 12 years are sensitive to extreme events however they are less likely to have existing medical concerns.	6	Flooding impacts likely to be managed by parents and carers	9	There are existing emergency response plans in place	7



Appendix C

Individual results of four approaches to analysing the Integrated Vulnerability Assessment

Average vulnerability of 16 and over

Condition and extent of beaches and dunes
Condition of built cultural heritage (e.g. heritage buildings, bridges, monuments, public art)
Effective functioning of built assets and contents (houses)
Effective operation of built assets and contents (business and industry)
Effective operation of coastal assets
Effective operation of electricity supply
Effective operation of rail network
Effective operation of road network
Incidence of anti-social behaviour
Incidence of social behaviour-Neighbourly interactions
Members of the community who require assistance for core activities
Potential for future industrial development

Maximum individual vulnerability of 18 or over

Condition and extent of beaches and dunes
Condition and extent of native vegetation cover by vegetation type
Condition of benthic habitat (e.g. sea grass, pests)
Contribution to Gross Regional Product (Western Adelaide Region)
Effective functioning of active recreation and sporting sites (indoor and outdoor)
Effective functioning of built assets and contents (houses)
Effective functioning of cycling and walking infrastructure (e.g. footpaths etc.)
Effective functioning of recreation facilities (e.g. Surf Life Saving Clubs, playgrounds)
Effective functioning of stormwater management infrastructure (drains, gutters, pipes)
Effective operation of built assets and contents (business and industry)
Effective operation of coastal assets
Incidence of social behaviour-Neighbourly interactions
Members of the community living with mental health problems
Members of the community who require assistance for core activities
Members of the community with poor self-assessed health
Older members of the community (aged >75)
Potential for future industrial development
Quality of water – coastal/estuaries
Quality of water - inland waters

**Average vulnerability score of 16 and over OR a maximum individual vulnerability score of 18 or over**

Condition and extent of beaches and dunes

Condition and extent of native vegetation cover by vegetation type

Condition of benthic habitat (e.g. sea grass, pests)

Condition of built cultural heritage (e.g. heritage buildings, bridges, monuments, public art)

Effective functioning of active recreation and sporting sites (indoor and outdoor)

Effective functioning of built assets and contents (houses)

Effective functioning of cycling and walking infrastructure (e.g. footpaths etc.)

Effective functioning of recreation facilities (e.g. Surf Life Saving Clubs, playgrounds)

Effective functioning of stormwater management infrastructure (drains, gutters, pipes)

Effective operation of built assets and contents (business and industry)

Effective operation of coastal assets

Effective operation of electricity supply

Effective operation of rail network

Effective operation of road network

Incidence of anti-social behaviour

Incidence of social behaviour-Neighbourly interactions

Members of the community living with mental health problems

Members of the community who require assistance for core activities

Members of the community with poor self-assessed health

Older members of the community (aged >75)

Potential for future industrial development

Quality of water – coastal/estuaries

Quality of water - inland waters

**Individual aspects or features with an average vulnerability score of 16 and over OR a maximum individual vulnerability score of 18 or over**

Above ground infrastructure (gutters, drains, pump stations)
Barker Inlet/Lipson Reach
Beach access paths
Beaches with backshore vegetated dunes south of Bower Road
Beaches without backshore vegetated dunes
Below ground infrastructure
Coastal shrubland and remnant dune vegetation (including Spinifex grassland)
Commercial and industrial buildings (private) Small to Medium Enterprises (SMEs)
Condition of built cultural heritage
Construction and Wholesale Trade sector
Cycling and walking infrastructure
Electricity infrastructure
Existing sea walls
Gillman development area
Houses / residential buildings and contents (privately owned) - Newer houses with higher finished flood levels
Houses / residential buildings and contents (privately owned) - Older houses with lower finished flood levels
Incidence of anti-social behaviour
Indoor facilities
Jetties
Mangroves
Manufacturing sector
Members of the community living with mental health problems
Members of the community who require assistance for core activities
Members of the community with poor self-assessed health
Neighbourly interactions
Older members of the community
Port River
Public housing - buildings and contents
Rail infrastructure
Road infrastructure
Samphire shrubland
Seagrass
Surf Life Saving Clubs
Transport Postal Warehousing sector
West Lakes



Appendix D

Key decision areas and relevant indicators and features



Theme	Proposed key area of decision making	Relevant indicators from IVA analysis	Key features or aspects
Vulnerable members of the community (i.e. those living with mental health issues or poor health or 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 to cope better with extreme events such as more frequent and intense heatwaves and flooding?	Members of the community who require assistance for core activities Members of the community living with mental health problems Members of the community with poor self-assessed health Older members of the community (aged >75)	Members of the community who require assistance for core activities Members of the community living with mental health problems Members of the community with poor self-assessed health Older members of the community (aged >75)
Public coastal built assets (eg paths, jetties, boat ramps, Surf Life Saving Clubs)	How do we provide, protect and manage public coastal assets as the sea level rises?	Effective functioning of recreation facilities (e.g. SLSC, playgrounds) Effective functioning of cycling and walking infrastructure (e.g. footpaths etc.) Effective functioning of active recreation and sporting sites (indoor and outdoor) Effective operation of coastal assets Condition of built cultural heritage (e.g. heritage buildings, bridges, monuments, public art)	Surf Life Saving Clubs Cycling and walking infrastructure Beach access paths Jetties Boat ramps Marina Existing sea walls Built cultural heritage
Open and green spaces and recreation areas (eg playgrounds, indoor and outdoor recreation sites, street trees and landscaped public realm)	How do we provide, protect and manage open and green spaces as we experience warmer and drier conditions, more frequent and intense heatwaves and the sea level rises?	Effective functioning of active recreation and sporting sites (indoor and outdoor) Effective functioning of cycling and walking infrastructure (e.g. footpaths etc.) Effective functioning of public realm (green assets - trees and landscaping)	Indoor facilities Cycling and walking infrastructure Playgrounds Outdoor grassed facilities (including irrigated areas) Outdoor paved/hard facilities Open space Green assets - trees and landscaping



Theme	Proposed key area of decision making	Relevant indicators from IVA analysis	Key features or aspects
Natural landscapes-coastal	How do we protect and enhance the condition of natural coastal landscapes as the sea level rises?	Condition and extent of beaches and dunes Condition and extent of native vegetation cover by vegetation type	Beaches without backshore vegetated dunes Beaches with backshore vegetated dunes south of Bower Road Beaches with backshore vegetated dunes north of Bower Road Coastal shrubland and remnant dune vegetation (including Spinifex grassland) Mangroves Samphire shrubland
Natural landscape-estuarine	How do we protect and enhance the condition of natural estuarine landscapes as the sea level rises?	Condition and extent of native vegetation cover by vegetation type	Mangroves Samphire shrubland
Urban living	How do we create better amenity and liveability in our urban areas as our climate becomes warmer and drier, we experience more frequent and intense heatwaves, rainfall intensity increases and the sea level rises?	Effective functioning of built assets and contents (houses)	Public housing - buildings and contents Houses / residential buildings and contents (privately owned) - Older houses with lower finished floor levels Houses / residential buildings and contents (privately owned) - Newer houses with higher finished floor levels
Stormwater management infrastructure	How do we design, construct and maintain stormwater management infrastructure as annual rainfall declines, rainfall intensity increases and the sea level rises?	Effective functioning of stormwater management infrastructure (drains, gutters, pipes)	Above ground infrastructure (gutters, drains, pump stations) Below ground infrastructure
Community connectedness	How do we build a strong and connected community as we experience more frequent and intense heatwaves and flooding?	Incidence of social behaviour- Neighbourly interactions	Neighbourly interactions



Theme	Proposed key area of decision making	Relevant indicators from IVA analysis	Key features or aspects
Business and industry	How do we enable business and industry to prosper as rainfall intensity increases and the sea level rises?	Contribution to Gross Regional Product Effective operation of built assets and contents (business and industry) Potential for future industrial development	Commercial and industrial buildings (private) Small-Medium Enterprises (SME) Commercial and industrial buildings (private) Larger enterprises
Transport and essential services	How do we minimise disruption to transport and essential services as we experience more frequent and intense heatwaves, increased rainfall intensity and sea level rise?	Effective operation of rail network Effective operation of road network Effective operation of electricity supply	Electricity infrastructure Road infrastructure Rail infrastructure
Inland waters	How do we maintain the amenity and function of inland waters as we experience more frequent and intense heatwaves, rainfall intensity increases and the sea level rises?	Quality of water - inland waters	River Torrens West Lakes Other watercourses
Estuarine waters	How do we maintain the amenity and function of estuarine waters as we experience more frequent and intense heatwaves, rainfall intensity increases and the sea level rises?	Quality of water – coastal/estuaries	Port River Barker Inlet/Lipson Reach Gulf St Vincent waters