



## **Integrated Vulnerability Assessment: Economy and Infrastructure Workshop Summary**

During March 2015 three workshops were held for AdaptWest to gather input to the Integrated Vulnerability Assessment (IVA) process. Workshops were held in relation to three themes - Environment and Natural Resources, Economy and Infrastructure and Social and Community.

This summary relates to the Economy and Infrastructure workshop.

### **Objectives of the workshop**

The objectives of the workshop were to bring together a range of stakeholders that have a role or interest in the Western Adelaide Region to:

- Explain the IVA process;
- Involve stakeholders in confirming, refining and adding to the 'first pass' assessment undertaken by the AdaptWest project team; and
- Draw on the expertise and knowledge of stakeholders to complete the IVA.

### **Workshop process**

Participants at the workshop were assigned a group and tasked with assessing a selection of indicators using the IVA framework.

The IVA is a tool that helps to identify areas of vulnerability to the impacts of climate change. The IVA is designed to consider both the potential impacts of climate change (exposure and sensitivity) and the adaptive capacity of the region (the attributes that support its ability to cope or adjust to climate change impacts).

The IVA is an important part of the AdaptWest project as it will drive the development of adaptation options for the climate change adaptation plan for the Western Region to be prepared in the next stage of the project.

At the Economy and Infrastructure workshop the following aspects and features were assessed:

- Ability of WSUD features (including constructed wetlands) to function effectively
- Condition of built cultural heritage (e.g. heritage buildings, bridges, monuments, public art)
- Contribution to GRP
- 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)
- 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. SLSC, 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 defence industries
- Effective operation of electricity supply
- Effective operation of jetties and boat ramps and marinas
- 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.)
- Groundwater quantity and quality (for use by industry)
- Potential for future industrial development
- Quantity of stormwater generated

During the workshop participants confirmed the preliminary assessment undertaken by the project team in relation to the aspects or features listed above. Participants also considered the aspect or feature's ability to adapt, referred to as its adaptive capacity. In discussing adaptive capacity, a number of opportunities to adapt were also identified which will be taken through to the next stage of the project.

At the workshop, a facilitator facilitated and recorded discussion and entered scores in relation to the assessment directly into an Excel spreadsheet. During this process it was emphasised that the qualitative information being collected during discussion amongst participants was just as, if not more important, than the numbers being entered.

The information collected by this process as input to the IVA being prepared for AdaptWest is provided in the attached Excel spreadsheet.

### **Next steps**

The information collected across the three IVA workshops will be consolidated, documented and analysed in the IVA report to be prepared for stage two of the AdaptWest project. The information collected will directly inform the identification of key areas of vulnerability and resilience for the Western Adelaide Region and drive the adaptation planning process to be undertaken in stage three of the project.

Grouping	Subgroup	Indicator /s	Feature to score	Exposure (Climate Variable)	Exposure Score	Sensitivity to Climate Variable	Comment	Potential Impact	Adaptive Capacity Score	Adaptive Capacity Workshop Comment	Vulnerability Score	Adaptation Options
Economic and Infrastructure	Buildings and Infrastructure	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	Direct impact of rainfall and flooding is short term although buildings with old or already sensitive roofs could be more sensitive	9	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	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	Possible impacts from soil heavage through reduced soil moisture levels. Older buildings more sensitive.	8	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	
Economic and Infrastructure	Buildings and Infrastructure	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	Older buildings more sensitive to inundation. Contents may also be of value and sensitive.	9	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	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	Flood water short term impacts affecting access and damage to contents and structure Newer buildings have higher finished flood levels	9	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	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	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	17	
Economic and Infrastructure	Buildings and Infrastructure	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	Flood water short term impacts affecting access and damage to contents and structure Older buildings have lower FFL but generally more robust construction	9	2	Limited adaptive capacity - costly for private owners to stabilise footings.	17	
Economic and Infrastructure	Buildings and Infrastructure	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	Bluestone footings more susceptible to soil heavage damage as soil moisture levels reduce	9	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	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	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	Effective functioning of built assets and contents (houses)	Public housing - buildings and contents	Rainfall intensity increase	5	4 - Moderate to High	Public housing may be less well maintained and hence more sensitive than private housing	9	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	16	
Economic and Infrastructure	Buildings and Infrastructure	Effective functioning of built assets and contents (houses)	Public housing - buildings and contents	Sea level rise	5	5 - High	May require building structural changes or relocation	10	2		18	
Economic and Infrastructure	Water / Engineering	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	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	Effective functioning of tourist facilities (e.g. Henley Square, Port Wharf markets, Adelaide Shores etc.)	Tourist facilities	Sea level rise	5	5 - High	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		

Grouping	Subgroup	Indicator /s	Feature to score	Exposure (Climate Variable)	Exposure Score	Sensitivity to Climate Variable	Comment	Potential Impact	Adaptive Capacity Score	Adaptive Capacity Workshop Comment	Vulnerability Score	Adaptation Options
Economic and Infrastructure	Buildings and Infrastructure	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	Potentially sensitive and valuable contents inside buildings, building itself may be less sensitive Larger enterprises	9	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	Awareness and education of hazards Sand bags available from SES Capacity to retrofit buildings Development plan changes to prevent buildings in high risk areas Relocation of businesses Role of Business SA and other groups Property owners play a role in emergency management Emergency management kit with relevant information for SMEs ZEMPs linkages Insurance ability to get and need types of cover that may be required
Economic and Infrastructure	Buildings and Infrastructure	Effective operation of built assets and contents (business and industry)	Commercial and industrial buildings (private) Larger enterprises	Sea level rise	5	5 - High	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		
Economic and Infrastructure	Buildings and Infrastructure	Effective operation of built assets and contents (business and industry)	Commercial and industrial buildings (private) SME	Rainfall intensity increase	5	4 - Moderate to High	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	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	Effective operation of built assets and contents (business and industry)	Commercial and industrial buildings (private) SME	Sea level rise	5	5 - High	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		
Economic and Infrastructure	Buildings and Infrastructure	Effective operation of coastal assets	Beach access paths	Sea level rise	5	5 - High	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	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	16	
Economic and Infrastructure	Buildings and Infrastructure	Effective operation of coastal assets	Boat ramps	Sea level rise	5	4 - Moderate to High	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	2	Rebuild is generally option for future SLR, very expensive, heritage issues also (listing - Henley Jetty)	17	
Economic and Infrastructure	Buildings and Infrastructure	Effective operation of coastal assets	Existing sea walls	Sea level rise	5	5 - High	Older sea walls less well constructed and many areas have been seen to be damaged in storm events	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,		Currently maintenance programs has budget that would not consider more frequent requirements for works Sand blown following storm events More frequent storm events Beach steps have to be closed Funding issues for both Councils and CPB Numerous options been tried, rates increase to enable more works, need to make community aware of high costs of maintenance and repair Greater community understanding of coastal processes Service levels within asset management plans Safety issues require regular closure following storm events FUNDING FUNDING FUNDING Increase rates or reduce services??
Economic and Infrastructure	Buildings and Infrastructure	Effective operation of coastal assets	Jetties	Sea level rise	5	5 - High	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	1	Existing older walls require more regular maintenance and built to different standards, limited funding available, management and maintenance responsibilities unclear		
Economic and Infrastructure	Buildings and Infrastructure	Effective operation of coastal assets	Marina	Sea level rise	5	5 - High	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	

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Economic and Infrastructure	Buildings and Infrastructure	Effective operation of public buildings (incl. Schools, libraries, hospitals)	Hospitals and health care facilities - building and contents	Sea level rise	5	4 - Moderate to High	Sensitive as result of the role in the community and facilities contained within	9	8	Buildings have high AC but people and electricity (considered elsewhere) have lower AC	11	
Economic and Infrastructure	Buildings and Infrastructure	Effective operation of public buildings (incl. Schools, libraries, hospitals)	Hospitals and health care facilities (including residential aged care) - building and contents	Heat wave increase frequency and intensity	5	1 - Low	Low sensitivity to heat wave. People and electricity supply (considered in other indicators) are sensitive aspects	6	8	Buildings have high AC but people and electricity (considered elsewhere) have lower AC	8	
Economic and Infrastructure	Buildings and Infrastructure	Effective operation of public buildings (incl. Schools, libraries, hospitals)	Hospitals and health care facilities (including residential aged care) - building and contents	Rainfall intensity increase	5	4 - Moderate to High	Sensitive to flooding as result of the role in the community and contents access issues following intense rain events	9	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	Effective operation of public buildings (incl. Schools, libraries, hospitals)	Hospitals and health care facilities (including residential aged care) - building and contents	Rainfall reduction: winter-spring	5	2 - Low to Moderate	Older buildings could be at risk of soil heavage as reduced soil moisture	7	5	More older buildings, lower floor levels, less likely to have undertaken emergency planning as hospitals	12	
Economic and Infrastructure	Buildings and Infrastructure	Effective operation of public buildings (incl. Schools, libraries, hospitals)	Schools and libraries - building and contents	Heat wave increase frequency and intensity	5	1 - Low	Low sensitivity to heat wave. People and electricity supply (considered in other indicators) are sensitive aspects	6	4	In clay soils, more cracking potential New buildings designed for soil movement	12	
Economic and Infrastructure	Buildings and Infrastructure	Effective operation of public buildings (incl. Schools, libraries, hospitals)	Schools and libraries - building and contents	Rainfall intensity increase	5	3 - Moderate	Flooding impacts on building structure, maintenance and access	8	4	Maintenance issue Older buildings on bluestone buildings more sensitive, buildings constructed on fill may be more sensitive	14	
Economic and Infrastructure	Buildings and Infrastructure	Effective operation of public buildings (incl. Schools, libraries, hospitals)	Schools and libraries - building and contents	Rainfall reduction: winter-spring	5	2 - Low to Moderate	Older buildings could be at risk of soil heavage as reduced soil moisture	7	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)	10	
Economic and Infrastructure	Buildings and Infrastructure	Effective operation of public buildings (incl. Schools, libraries, hospitals)	Schools and libraries - building and contents	Sea level rise	5	4 - Moderate to High	Sensitive as result of the role in the community and contents	9	5	More older buildings, lower floor levels, less likely to have undertaken emergency planning as hospitals	14	
Economic and Infrastructure	Buildings and Infrastructure	Effective operation of rail network	Rail infrastructure	Heat wave increase frequency and intensity	5	4 - Moderate to High	Buckling of rail lines in extreme has been seen in recent heatwaves	9	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	Effective operation of rail network	Rail infrastructure	Rainfall intensity increase	5	3 - Moderate	Short term damage to rail infrastructure including culverts and track foundations, potential interruptions to signals and other infrastructure	8	3	Signal failure in 2014 caused disruption, close crossings	15	
Economic and Infrastructure	Buildings and Infrastructure	Effective operation of rail network	Rail infrastructure	Sea level rise	5	5 - High	Bridges and embankment stability sensitive to slr, salt water impact on soil stability and infrastructure	10	3		17	

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Economic and Infrastructure	Buildings and Infrastructure	Effective operation of road network	Road infrastructure	Heat wave increase frequency and intensity	5	4 - Moderate to High	Impact of heat on bitumen	9	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	Asset management plans have identified opportunities for new materials and options Asset management plans need to be more explicit about future impacts and future costs Design standards updates in some areas Consideration of longer term approach to road maintenance, change in materials could have longer lifespan Internal capacity building re implications of CC on assets, procurements, Infill development often requires construction of service trenches across roads, integrity of road network more at risk from flood etc LG could play role in better coordination with service providers for construction specifications etc
Economic and Infrastructure	Buildings and Infrastructure	Effective operation of road network	Road infrastructure	Rainfall intensity increase	5	3 - Moderate	Minor roads act as stormwater drainage, sensitive to increased flows	8	2	Design capacity may not be adequate to cope with increased runoff	16	LESSER ISSUES FOR DPTI ROADS? Likely to be bigger roads and requirements for road lane closure so more levels of
Economic and Infrastructure	Buildings and Infrastructure	Effective operation of road network	Road infrastructure	Sea level rise	5	4 - Moderate to High	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	2		17	
Economic and Infrastructure	Open Space and Recreation	Effective functioning of active recreation and sporting sites (indoor and outdoor)	Indoor facilities	Sea level rise	5	4 - Moderate to High	Inundation likely to cause damage to contents and possibly structure of facilities	9	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	18	
Economic and Infrastructure	Open Space and Recreation	Effective functioning of active recreation and sporting sites (indoor and outdoor)	Indoor facilities	Heat wave increase frequency and intensity	5	4 - Moderate to High	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	1	Very low adaptive capacity	18	
Economic and Infrastructure	Open Space and Recreation	Effective functioning of active recreation and sporting sites (indoor and outdoor)	Indoor facilities	Rainfall intensity increase	5	3 - Moderate	Structures may be sensitive to damage from intense rain events and flooding	8	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	17	Identify assets at risk and prioritise what do/strategic plan for action. Sandbagging, emergency response. Restrict new building in hazard prone areas. Acquisition of land/buildings where inundated. Develop better mapping/modelling to assist with planning. Improved building and planning standards re finished floor levels, building materials design features etc. Protection works/structures eg levy bank, sea wall etc. Abandon assets. Develop carbon neutral May become evacuation/emergency response centre so design to standard.
Economic and Infrastructure	Open Space and Recreation	Effective functioning of active recreation and sporting sites (indoor and outdoor)	Outdoor grassed facilities	Sea level rise	5	4 - Moderate to High	Grassed areas highly sensitive to inundation from sea water	9	1		18	Relocate inland. Incorporate into protection works eg along top of sea wall. Elevate pathways. Protection works.
Economic and Infrastructure	Open Space and Recreation	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	Irrigated grass areas sensitive to heat waves	9	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	17	Design techniques to accommodate temporary inundation. Abandon assets
Economic and Infrastructure	Open Space and Recreation	Effective functioning of active recreation and sporting sites (indoor and outdoor)	Outdoor grassed facilities	Rainfall intensity increase	5	4 - Moderate to High	Sensitive to impacts of flooding possible in short term, drainage issues, safety	9	2		17	
Economic and Infrastructure	Open Space and Recreation	Effective functioning of active recreation and sporting sites (indoor and outdoor)	Outdoor grassed facilities	Rainfall reduction: winter-spring	5	5 - High	Quality of grassed areas will be reduced as rainfall decreases, and use of facilities increases as weather more suitable for outdoor activities	10	2	Grass doesn't like saltwater. Limited if any protection structures in place	18	relocate facilities
Economic and Infrastructure	Open Space and Recreation	Effective functioning of active recreation and sporting sites (indoor and outdoor)	Outdoor paved / hard facilities	Sea level rise	5	3 - Moderate	Paved areas could require increased maintenance, less sensitive than grassed areas	8	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	Effective functioning of active recreation and sporting sites (indoor and outdoor)	Outdoor paved / hard facilities	Heat wave increase frequency and intensity	5	3 - Moderate	Less sensitive to heat waves than grassed areas, increased hot weather could require more frequent maintenance due to cracking of surfaces	8	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	15	Improved species selection. Accelerated WSUD. Capture and reuse stormwater, particularly along streets-integrated design of roads and runoff to trees. Permeable paving/surfaces. Climate sensitive urban design guidelines. Plant for carbon sequestration. Educate the community /raise awareness regarding standards of maintenance etc.

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Economic and Infrastructure	Open Space and Recreation	Effective functioning of active recreation and sporting sites (indoor and outdoor)	Outdoor paved / hard facilities	Rainfall intensity increase	5	4 - Moderate to High	Sensitive to impacts of flooding possible in short term, more likely to be sensitive to erosion than grassed facilities	9	1	Can deconstruct and relocate to alternative location	18	
Economic and Infrastructure	Open Space and Recreation	Effective functioning of active recreation and sporting sites (indoor and outdoor)	Outdoor paved / hard facilities	Rainfall reduction: winter-spring	5	2 - Low to Moderate	Hard surface facilities less sensitive	7	4	AC will vary between sites. Some infrastructure has moderate AC other sites have low AC	13	
Economic and Infrastructure	Open Space and Recreation	Effective functioning of cycling and walking infrastructure (e.g. footpaths etc.)	Cycling and walking infrastructure	Sea level rise	5	4 - Moderate to High	Possibly more sensitive as not built to road standards, sensitive to coastal erosion	9	3		16	
Economic and Infrastructure	Open Space and Recreation	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	Impact of heat on bitumen	9	2		17	
Economic and Infrastructure	Open Space and Recreation	Effective functioning of cycling and walking infrastructure (e.g. footpaths etc.)	Cycling and walking infrastructure	Rainfall intensity increase	5	3 - Moderate	Sensitive to erosion on path edges	8	3	Sewer system is already struggling with stormwater incursion.	15	
Economic and Infrastructure	Open Space and Recreation	Effective functioning of open space (predominantly green space)	Condition of open space	Heat wave increase frequency and intensity	5	4 - Moderate to High	Grass and landscaped areas possibly sensitive to heat waves. Risk of trees falling on residents.	9	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	rationalise irrigated open space. Identify those which need to be better quality. Use of drought tolerant species for turf. Use of synthetic surfaces. Shading of facilities eg lawn bowls
Economic and Infrastructure	Open Space and Recreation	Effective functioning of open space (predominantly green space)	Condition of open space	Rainfall intensity increase	5	3 - Moderate	Quality of grassed areas sensitive to prolonged periods of inundation	8	3	Undermining, damage to surfaces	15	
Economic and Infrastructure	Open Space and Recreation	Effective functioning of open space (predominantly green space)	Condition of open space	Rainfall reduction: winter-spring	5	4 - Moderate to High	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	3	Impact on pump stations is mid range. Impact on flow paths is high.	16	
Economic and Infrastructure	Open Space and Recreation	Effective functioning of public realm (constructed assets, fountains etc.)	Constructed assets	Sea level rise	5	3 - Moderate	Inundation may cause direct damage or impacts to soil stability, salt could affect materials	8	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	Open Space and Recreation	Effective functioning of public realm (constructed assets, fountains etc.)	Constructed assets	Heat wave increase frequency and intensity	5	3 - Moderate	Some materials (plastics and metals) sensitive to high temperatures	8	6	AC depends on what effective functioning means. Several schemes are already producing more water than the demand	12	
Economic and Infrastructure	Open Space and Recreation	Effective functioning of public realm (green assets - trees and landscaping)	Green assets - trees and landscaping	Heat wave increase frequency and intensity	5	5 - High	Heat waves can cause damage and death to green assets	10	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	15	Rationalise what irrigate to better levels. Maintain smaller amounts to higher standard. Change in community expectations
Economic and Infrastructure	Open Space and Recreation	Effective functioning of public realm (green assets - trees and landscaping)	Green assets - trees and landscaping	Rainfall reduction: winter-spring	5	5 - High	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	5	Working with today's level of hard surfaces (as opposed to increasing densification of housing)	15	
Economic and Infrastructure	Open Space and Recreation	Effective functioning of public realm (green assets - trees and landscaping)	Green assets - trees and landscaping	Rainfall reduction: summer-autumn	2	3 - Moderate	Vegetation sensitive to reduced episodic rainfall during summer	5	5	Working with today's level of hard surfaces (as opposed to increasing densification of housing)	10	

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Economic and Infrastructure	Open Space and Recreation	Effective functioning of public realm (green assets - trees and landscaping)	Green assets - trees and landscaping	Temperature increase	5	3 - Moderate	Hotter temperatures stress tree and vegetation health	8	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	12	
Economic and Infrastructure	Open Space and Recreation	Effective functioning of public realm (green assets - trees and landscaping)	Green assets - trees and landscaping	Rainfall intensity increase	5	3 - Moderate	Landscape features sensitive to flooding and associated erosion	8	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	root control barriers around courts so can provide natural shade.
Economic and Infrastructure	Open Space and Recreation	Effective functioning of recreation facilities (e.g. SLSC, playgrounds)	Playgrounds	Sea level rise	5	3 - Moderate	SLR impacts on condition (flooding and erosion) and ability for use	8	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)	12	
Economic and Infrastructure	Open Space and Recreation	Effective functioning of recreation facilities (e.g. SLSC, playgrounds)	Playgrounds	Heat wave increase frequency and intensity	5	4 - Moderate to High	Some materials (plastics and metals) sensitive to high temperatures	9	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 .	12	
Economic and Infrastructure	Open Space and Recreation	Effective functioning of recreation facilities (e.g. SLSC, playgrounds)	Playgrounds	Rainfall intensity increase	5	3 - Moderate	SLR impacts on condition (flooding and erosion) and ability for use	8	5	Shade structure plan has been prepared. Commencing container shade structures	13	
Economic and Infrastructure	Open Space and Recreation	Effective functioning of recreation facilities (e.g. SLSC, playgrounds)	SLSC	Sea level rise	5	5 - High	Sensitive to erosive impacts of slr and storm surge	10	5	Discussed but not scored - MS has assigned score of 5 based on discussion	15	
Economic and Infrastructure	Open Space and Recreation	Effective functioning of recreation facilities (e.g. SLSC, playgrounds)	SLSC	Heat wave increase frequency and intensity	5	3 - Moderate	Structural impacts as well as those associated with increased demand / use during periods of hot weather	8	5	Discussed but not scored - MS has assigned score of 5 based on discussion	13	
Economic and Infrastructure	Water / Engineering	Ability of WSUD features (including constructed wetlands) to function effectively	MAR recharge and storage	Rainfall reduction: winter-spring	5	5 - High	Less water available for recharge	10	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	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	Vegetation associated with WSUD may be less sensitive to hot days as potentially greater soil moisture or surface water present	8	7		11	
Economic and Infrastructure	Water / Engineering	Ability of WSUD features (including constructed wetlands) to function effectively	WSUD wetlands, swales and vegetated treatments	Rainfall reduction: winter-spring	5	5 - High	Change to water regime of WSUD sites and water levels, and vegetation demand for water, increased maintenance costs	10	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	13	
Economic and Infrastructure	Water / Engineering	Ability of WSUD features (including constructed wetlands) to function effectively	WSUD wetlands, swales and vegetated treatments	Temperature increase	5	4 - Moderate to High	Potential impact on water regime of WSUD sites and water levels, and vegetation demand for water, increased maintenance costs	9	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 .	16	
Economic and Infrastructure	Water / Engineering	Ability of WSUD features (including constructed wetlands) to function effectively	WSUD wetlands, swales and vegetated treatments	Rainfall intensity increase	5	5 - High	Water treatment not effective during high flows,	10	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	14	
Economic and Infrastructure	Water / Engineering	Effective functioning of stormwater management infrastructure (drains, gutters, pipes)	Above ground infrastructure (gutters, drains, pump stations)	Rainfall intensity increase	5	5 - High	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	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	13	Material selection, shift to nature based playspaces, shade structures. Water play, shading of infrastructure and seating. Consolidation of playgrounds



Grouping	Subgroup	Indicator /s	Feature to score	Exposure (Climate Variable)	Exposure Score	Sensitivity to Climate Variable	Comment	Potential Impact	Adaptive Capacity Score	Adaptive Capacity Workshop Comment	Vulnerability Score	Adaptation Options
Economic and Infrastructure	Water / Engineering	Effective functioning of stormwater management infrastructure (drains, gutters, pipes)	Above ground infrastructure (gutters, drains, pump stations)	Sea level rise	5	3 - Moderate	Pump stations designed to cope with surface inundation	8	3	There is limited capacity in the existing infrastructure	15	
Economic and Infrastructure	Water / Engineering	Effective functioning of stormwater management infrastructure (drains, gutters, pipes)	Below ground infrastructure	Sea level rise	5	5 - High	Erosion at outlet, sea water intrusion to stormwater infrastructure will	10	9	Most systems are designed to overflow. Scour is the only potential risk	11	
Economic and Infrastructure	Water / Engineering	Effective functioning of stormwater management infrastructure (drains, gutters, pipes)	Below ground infrastructure	Rainfall reduction: winter-spring	5	3 - Moderate	Damage to underground infrastructure as result of soil heave caused by changes in soil moisture, infrastructure design capacity may not be sufficient for higher flows	8	8	will contribute to localised flooding due to run off. Can undermine and accelerate deterioration if already cracked. Design standards in place.	10	
Economic and Infrastructure	Water / Engineering	Effective functioning of tourist facilities (e.g. Henley Square, Port Wharf markets, Adelaide Shores etc.)	Tourist facilities	Sea level rise	5	5 - High	SLR impacts on condition (flooding and erosion) and ability for use	10	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	increased water capture and reuse
Economic and Infrastructure	Water / Engineering	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	Increased maintenance to exteriors exposed to greater heat	8	7	Undermining, damage to surfaces, erosion, often along drainage corridors so flooded and reduced use	11	build gabion walls to reduce erosion, culverts
Economic and Infrastructure	Water / Engineering	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	Damage to underground infrastructure as result of soil heave caused by changes in soil moisture	9	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	12	
Economic and Infrastructure	Water / Engineering	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	Damage to underground infrastructure as result of soil heave caused by changes in soil moisture	5	8	Loss of amenity. Reduced mowing regime and cost savings. Extend irrigation season, drought tolerant plants	7	
Economic and Infrastructure	Water / Engineering	Effective operation of potable water supply (e.g. pipes and pumps) and treatment plants	Wastewater treatment infrastructure	Rainfall reduction: winter-spring	5	3 - Moderate	Damage to underground infrastructure as result of soil heave caused by changes in soil moisture	8	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	Guidelines re material selection
Economic and Infrastructure	Water / Engineering	Effective operation of potable water supply (e.g. pipes and pumps) and treatment plants	Wastewater treatment infrastructure	Sea level rise	5	3 - Moderate	Damage to underground infrastructure, Glenelg WWTP flooding could cause disruption to treatment processes	8	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	Water / Engineering	Effective operation of potable water supply (e.g. pipes and pumps) and treatment plants	Wastewater treatment infrastructure	Rainfall reduction: summer-autumn	2	3 - Moderate	Damage to underground infrastructure as result of soil heave caused by changes in soil moisture	5	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.	7	
Economic and Infrastructure	Water / Engineering	Effective operation of potable water supply (e.g. pipes and pumps) and treatment plants	Water supply infrastructure	Sea level rise	5	3 - Moderate	Damage to underground infrastructure as result of sea water intrusion, changes in soil condition with subsequent impacts on potable water supply	8	8	Increased use/demand, accelerated deterioration, power disruption, HVAC	10	
Economic and Infrastructure	Water / Engineering	Effective operation of wastewater treatment systems (e.g. pipes, plant, distribution etc.)	Wastewater treatment infrastructure	Rainfall intensity increase	5	4 - Moderate to High	Flooding results in sewer overflow, potential contamination, overload of stormwater transfer, existing ww network been prone to flood inundation and high downstream runoff	9	8	Almost beneficial	11	
Economic and Infrastructure	Water / Engineering	Groundwater quantity and quality (for use by industry)	Groundwater quantity and quality	Rainfall reduction: winter-spring	5	5 - High	Recharge (although outside the Region) is highly sensitive to reductions in winter - spring rainfall	10	5	Discussed but not scored - MS has assigned score of 5 based on discussion	15	
Economic and Infrastructure	Water / Engineering	Quantity of stormwater generated	Quantity of stormwater	Rainfall intensity increase	5	4 - Moderate to High	More flash events during summer when low infiltration, highly impervious catchment and future increase in housing density	9	9	Use alternative facility. Some limited damage. Bark chips/rubber soft fall affected by flooding. Frequent monitoring and maintenance regime. Equipment standards re construction	10	
Economic and Infrastructure	Water / Engineering	Quantity of stormwater generated	Quantity of stormwater	Rainfall reduction: winter-spring	5	4 - Moderate to High	More flash events during summer when low infiltration, highly impervious catchment and future increase in housing density	9	10	Could result in increased soil movement and undermine surfaces.	9	