

His Worship the Mayor
Councillors
CITY OF MARION



**NOTICE OF
INFRASTRUCTURE AND STRATEGY COMMITTEE MEETING**

Notice is hereby given pursuant to the provisions under Section 83 of the Local Government Act 1999 that a General Council meeting will be held

Tuesday 3 April 2018

Commencing at 6.30pm

In the Chamber

Council Administration Centre

245 Sturt Road, Sturt

A copy of the Agenda for this meeting is attached in accordance with Section 83 of the Act.

Meetings of the Council are open to the public and interested members of this community are welcome to attend. Access to the Chamber is via the main entrance to the Administration building on Sturt Road, Sturt.

A handwritten signature in purple ink, appearing to read "Adrian", with a stylized flourish at the end.

Adrian Skull
CHIEF EXECUTIVE OFFICER

29 March 2018

**CITY OF MARION
INFRASTRUCTURE & STRATEGY COMMITTEE AGENDA
FOR THE MEETING TO BE HELD ON
TUESDAY 3 APRIL 2018
COMMENCING AT 6.30 PM
COUNCIL CHAMBER
245 STURT ROAD, STURT**



1. OPEN MEETING

2. KAURNA ACKNOWLEDGEMENT

We acknowledge the Kaurna people, the traditional custodians of this land and pay our respects to their elders past and present.

3. MEMBER'S DECLARATION OF INTEREST (if any)

4. CONFIRMATION OF MINUTES

- 4.1 Confirmation of the minutes for the Infrastructure & Strategy Committee meeting held on 6 March 20184

5. BUSINESS ARISING

- 5.1 Review of the Business Arising from previous meetings of the Infrastructure and Strategy Committee Meetings.....9

6. REPORTS FOR NOTING

- 6.1 Nil

7. CONFIDENTIAL REPORTS

- 7.1 Nil

8. REPORTS FOR DISCUSSION

- 8.1 Oaklands Wetland Water Project
Report Reference: ISC030418R8.117

9. WORKSHOP

- 9.1 Smart Cities Opportunities
Report Reference: ISC030418R9.1 24
External – Adam Gray, Smart Cities Consultant

10. PRESENTATION

- 10.1 Coastal Management Plan
Report Reference: ISC030418R10.178
External – Mark Western, Integrated Coasts

11. ANY OTHER BUSINESS

12. MEETING CLOSURE

The Infrastructure & Strategy Committee meeting shall conclude on or before 9.30 pm unless there is a specific motion adopted at the meeting to continue beyond that time.

13. NEXT MEETING

The next meeting of the Infrastructure & Strategy Committee is scheduled to be held:

Time: 6.30pm

Date: 1 May 2018

Venue: The Council Chamber, Administration Office, 245 Sturt Road, Sturt

APPENDIX 1

**MINUTES OF THE INFRASTRUCTURE AND STRATEGY COMMITTEE
HELD AT ADMINISTRATION CENTRE
245 STURT ROAD, STURT
ON TUESDAY 6 MARCH 2018**



PRESENT

Elected Members

Councillor Luke Hutchinson (*Presiding Member*), Councillor Tim Pfeiffer , Councillor Nathan Prior, Councillor Tim Gard and Councillor Bruce Hull

Independent Member

Mr Christian Reynolds

In Attendance

| | |
|-------------------|------------------------------------|
| Councillor | Janet Byram |
| Councillor | Raelene Telfer |
| Councillor | Jason Veliskou |
| Councillor | Ian Crossland |
| Mr Adrian Skull | Chief Executive Officer |
| Ms Abby Dickson | General Manager City Development |
| Mr Tony Lines | General Manager City Services |
| Mr Vincent Mifsud | General Manager Corporate Services |
| Ms Fiona Harvey | Manager Innovation and Strategy |
| Mr Greg Salmon | Manager City Activation |
| Mr John Deally | Manager ICT |
| Ms Elaine Delgado | Strategy Leader (minute taker) |

1. OPEN MEETING

The meeting commenced at 6.33pm.

2. KAURNA ACKNOWLEDGEMENT

We acknowledge the Kurna people, the traditional custodians of this land and pay our respects to their elders past and present.

3. MEMBERS DECLARATION OF INTEREST

The Chair asked if any Member wished to disclose an interest in relation to any item being considered at the meeting.

- No declarations were made.

4. CONFIRMATION OF MINUTES

Members noted the comments relating to the Committee's Terms of Reference in the minutes.

Moved Cr Gard, Seconded Mr Reynolds the minutes of the Infrastructure and Strategy Committee Meeting held on 6 February 2018 be taken as read and confirmed.

Carried unanimously

5. BUSINESS ARISING

5.1 Review of the Business Arising from previous meetings of the Infrastructure and Strategy Committee Meetings

The need for a whole-of-city approach to Smart Cities was discussed with the following points made:

- A Smart Cities pilot study is currently being scoped and a business case developed
- Smart Cities is a broad topic with potential opportunities to:
 - Obtain accurate baseline data to inform service levels in locations, such as the Tonsley residential site and open spaces
 - Partner with different business sectors in Tonsley to further Council's Smart City agenda where there is the opportunity for beneficial outcomes to be delivered for the City of Marion's community
 - Council's 10-Year Strategic Plan is a pivotal document in identifying Smart City pilot projects to pursue
 - Find industry partners to advise and work with Council
- It is important that Council does not work in a 'silo' and is informed about other government sector priorities and associated timeframes

Cr Pfeiffer entered meeting at 6.50pm

5.2 Meeting Schedule and Work Program for 2018

Members provided the following suggestions:

- No agenda items should be scheduled for November due to Council elections
- The two items scheduled for November to be included in the October meeting agenda
- Reschedule the Smart Cities Pilot Project Opportunities agenda item from April to May
- Reschedule some May agenda items to enable the inclusion of the Smart Cities item
- Include agenda item 'Infrastructure and Strategy Committee Handover' in October

ACTION: Prepare Smart Cities 'roadmap' for discussion at the May meeting

6. REPORTS FOR NOTING

Infrastructure Projects Progress Updates **Report Reference: ISC060318R6.1**

The following points were noted on projects progress updates:

- Glenthorne Farm project has been removed from the progress updates as it is no t currently active
- The Lorenzin/Seacliff Park project is not Council driven but has been addressed as a Development Plan Amendment
- Water from Oaklands Wetland is expanding each year to irrigate reserves with future potential to treat the water for residential use
- Mitchell Park Sports and Community Centre project is 'spade ready' but details on the provision of sport has yet to be finalised. Communications with residents have been undertaken. No external funding for the project has been confirmed at this stage.
- Project packs have been distributed to state government candidates and Basketball SA to advocate for external funding for 'spade ready' projects
- A coordinated and expanded communications approach is required to maximise the opportunity for project delivery

Actions:

- **A broad update of the Oaklands Wetland water project to be provided to the April 2018 Infrastructure and Strategy Committee meeting**
- **Ms Dickson to circulate communications on the Mitchell Park Sports and Community Centre project to Committee members**

Moved Cr Prior, Seconded Mr Reynolds that the Infrastructure and Strategy Committee:

1. Notes the progress report on key infrastructure projects

Carried unanimously

7. CONFIDENTIAL ITEMS

BMX Project – Progress Report **Report Reference: ISC060318F01**

Moved Cr Gard, Seconded Mr Reynolds that the Infrastructure and Strategy Committee:

1. Pursuant to Section 90(2) and (3)(d) of the Local Government Act 1999, the Committee orders that all persons present, with the exception of the following persons: Cr Byram; Cr Telfer; Cr Crossland; Cr Veliskou; Adrian Skull, Chief Executive Officer; Abby Dickson, General Manager City Development; Tony Lines, General Manager City Services; Vincent Mifsud, General Manager Corporate Services; Fiona Harvey, Manager Innovation and Strategy; Greg Salmon, Manager City Activation; John Deally, Manager ICT; and Elaine Delgado, Strategy Leader be excluded from the meeting as the Committee receives and considers information relating to the BMX Project, upon the basis that the Committee is satisfied that the requirement for the meeting to be conducted in a place open to the public has been outweighed by the need to keep consideration of the matter

confidential given the information relates to commercial information of a confidential nature, and would on balance, be contrary to the public interest commercial information.

Carried unanimously

7.40pm the meeting went into confidence.

Moved Cr Hull, Seconded Cr Gard that the Infrastructure and Strategy Committee:

1. In accordance with Section 91(7) and (9) of the Local Government Act 1999 the Committee orders that this report, BMX Project, associated appendices and the minutes arising from this report having been considered in confidence under Section 90(2) and 3 (d) of the Act, except when required to effect or comply with the Committee's resolution(s) regarding this matter, be kept confidential and not available for public inspection for a period of 12 months from the date of this meeting. This confidentiality order will be reviewed at the General Council Meeting in December 2018.

Carried unanimously

7.55pm the meeting came out of confidence

8. REPORTS FOR DISCUSSION

ICT Digital Transformation Plan Update Report Reference: ISC060318R8.1

Mr Mifsud and Mr Deally provided an overview of the report and the following points were raised:

- The list of projects are not prioritised which enables agility in responding to needs as they arise
- The ICT Strategy Roadmap is an enabler to deliver on strategic directions in the 10-Year Strategic Plan and 3-Year Business Plan
- ICT has a critical role in building a system to capture data as a 'single point of truth' to support informed and effective decision-making, including the Smart City agenda
- The Long Term Financial Plan includes **some** funding to cover new ICT initiatives as they arise
- Detailed design is being developed for a new transformational asset management system for **procurement in 2018/19**
- ICT and Customer Experience are working in partnership to ensure data collection and use supports a 'single view' of the customer so doing business with Council provides an informed and seamless experience
- The installation of a new City of Marion website, and software for Council's agendas and minutes will enable Elected Members to easily research the history of projects, such as the Marion Swimming Centre
- The next ICT update to support a discussion on a sequential roadmap that includes a critical path and addresses the purpose and benefits to be realised for 3 project classes – 1) Productivity/Enablers; 2) Regulatory/Legislative/Compliance; 3) IT Asset Renewal
- Consider the 5+ year timeframe for 'Use of robotics' – potential to move forward to 2-5 years
-

- A cyber-security framework is in place for the management of third party data with policies being updated to reflect this
- Effective and efficient collection and use of data is the 'backbone' for the organisation and is critical to a Smart City agenda

Action: ICT update scheduled for 4 September 2018 to support a discussion on a sequential roadmap that includes a critical path for 3 project classes addressing their purposes and benefits – 1) Productivity/Enablers; 2) Regulatory/Legislative/Compliance; 3) IT Asset Renewal

Moved Cr Gard, Seconded Cr Prior that the Infrastructure and Strategy Committee:

1. Notes this report.

Carried unanimously

9. WORKSHOP

Nil

10. PRESENTATION

Nil

11. ANY OTHER BUSINESS

Nil

12. MEETING CLOSURE

The meeting was declared closed at 8.40pm.

13. NEXT MEETING

The next meeting of the Infrastructure and Strategy Committee will be held at 6.30pm on 3 April 2018 in the Council Chamber, 245 Sturt Road, Sturt.

CONFIRMED

.....
CHAIRPERSON
/ /

CITY OF MARION
BUSINESS ARISING FROM THE INFRASTRUCTURE AND STRATEGY COMMITTEE MEETINGS

AS AT 03 APRIL 2018



| | Date of Meeting | Item | Responsible | Due Date | Status | Completed / Revised Due Date |
|----|-----------------|--|--------------|---------------|--|------------------------------|
| 1. | 1 August 2017 | 7.1 An update report on the ICT Digital Transformation Plan be provided to the Committee every six months (including, where possible, how the City of Marion compares to other Councils). | John Deally | February 2018 | Being presented at the 6 March meeting | 6 March 2018 |
| 2. | 6 February 2018 | 4 Terms of Reference and Overview of Skills <ul style="list-style-type: none"> Notes the Terms of Reference identified at Appendix 1 to the report be amended as follows: <ul style="list-style-type: none"> Include 3.4 under the section titled 'Elected Member Representatives' Reword 5.1.3 to ensure only strategic topics are included on the Committee's agenda Include a reference to Council's quest for Innovation Notes the overview of skills provided by the Expert Member. | Fiona Harvey | | Changes to the Terms of Reference will require a resolution of Council, therefore the Committee may wish to consider whether they progress these changes | 6 March 2018 |
| 3. | 6 February 2018 | 6.1 Business Arising Smart Street Lighting Infrastructure <ul style="list-style-type: none"> A report be presented to the April 2018 meeting of the Infrastructure and Strategy Committee outlining: <ul style="list-style-type: none"> ➤ Smart Cities commercial and technological advancements to inform potential partnership opportunities, including any commercial penalties, for a pilot project. ➤ Smart Cities projects being undertaken by other councils. ➤ Approach SAPN to deliver an accelerated program of delivery for Stages 2 and 3. | | 3 April 2018 | Report scheduled for April 2018 Committee meeting | |

| | Date of Meeting | Item | Responsible | Due Date | Status | Completed / Revised Due Date |
|----|-----------------|--|----------------------------|------------------------------|--|----------------------------------|
| 4. | 6 February 2018 | 6.2 Setting of annual works program <ul style="list-style-type: none"> Council Administration to prepare an annual program for the I&S Committee based on feedback received during the meeting | Fiona Harvey | 6 March 2018 | Being presented at the 6 March meeting | COMPLETED 6 March 2018 |
| 5. | 6 February 2018 | 7.2 Energy Efficiency and Renewable Energy Roadmap <ul style="list-style-type: none"> Provides feedback on the draft Energy Efficiency and Renewable Energy Roadmap (Appendix 2) and the key questions posed for discussion. Notes that Energy Efficiency and Renewable Energy opportunities will be included in the Committee's 2018 Annual Works Program. | Ann Gibbons | 5 June 2018 | Report scheduled for June 2018 Committee meeting | |
| 6. | 6 March 2018 | 5.2 Meeting Schedule and work Program for 2018 <ul style="list-style-type: none"> Prepare Smart Cities 'roadmap' for discussion at the May meeting | Fiona Harvey | 1 May 2018 | Included in the upcoming item schedule for May 2018 | |
| 7. | 6 March 2018 | 6.1 Infrastructure Projects Progress Updates <ul style="list-style-type: none"> A broad update of the Oaklands Wetland water project to be provided to the April 2018 I&S Committee Meeting Communications on the Mitchell Park Sports & Community Centre project to be circulated to Committee members | Tony Lines Abby Dickson | 3 April 2018 3 April 2018 | Report drafted for 3 April meeting November flyer emailed 27/3/18 | COMPLETED 3 April 2018 |
| 8. | 6 March 2018 | 8.1 ICT Digital Transformation Plan Update <ul style="list-style-type: none"> ICT update scheduled for 4 September 2018 to support a discussion on a sequential roadmap that includes a critical path for 3 project classes addressing their purposes and benefits 1) Productivity/Enablers; 2) Regulatory/Legislative/Compliance; 3) IT Asset Renewal | John Deally | 4 September 2018 | | |

* Completed items to be removed are shaded

| | | |
|--------------------|--------------------|--------------------------------------|
| 6 February | 6.30 – 9.30 | Infrastructure & Strategy |
| 6 March | 6.30 – 9.30 | Infrastructure & Strategy |
| 3 April | 6.30 – 9.30 | Infrastructure & Strategy |
| 1 May | 6.30 – 9.30 | Infrastructure & Strategy |
| 5 June | 6.30 – 9.30 | Infrastructure & Strategy |
| 3 July | 6.30 – 9.30 | Infrastructure & Strategy |
| 7 August | 6.30 – 9.30 | Infrastructure & Strategy |
| 4 September | 6.30 – 9.30 | Infrastructure & Strategy |
| 2 October | 6.30 – 9.30 | Infrastructure & Strategy |
| 6 November | 6.30 – 9.30 | Infrastructure & Strategy |
| 4 December | 6.30 – 9.30 | Infrastructure & Strategy |

- 1st Tuesday of each month from February – December 2018
- Membership – 5 Elected Members
- Quorum - 4 Committee Members
- Reference Minutes – GC241017R19

Presiding Member – Luke Hutchinson

Expert Member – Christian Reynolds

Members

- Tim Pfeiffer
- Nathan Prior
- Bruce Hull
- Tim Gard

Draft Infrastructure and Strategy Committee Program 2018

| Infrastructure & Strategy Committee Date: Tuesday, 6 February 2018 Time: 6.30pm – 9.30pm Venue: Committee Room | | | | |
|---|--------------------------------|----------|--------------------|-------------------|
| Topic | Description | Duration | External Attendees | Staff Responsible |
| Capella and Nannigai Precinct Plan | Action from 7 Nov 2017 meeting | | | Carol Hampton |
| Energy Efficiency and Renewable energy Roadmap | Action from 7 Nov 2017 meeting | | | Ann Gibbons |

| Meeting: Infrastructure & Strategy Committee Date: Tuesday 6 March Time: 6.30pm – 9.30pm Venue: Chamber | | | | | |
|--|----------------|---|----------|--------------------|-----------------------------|
| Topic | Type of Report | Description | Duration | External Attendees | Staff Responsible |
| Infrastructure Project Updates | R | For noting: Progress updates on key infrastructure projects Update on any emerging risks, significant changes | | | Abby Dickson |
| Draft Program 2018 | R | A draft program of agenda items for the Committee's consideration for 2018 | | | Abby Dickson/ Tony Lines |
| ICT Digital Transformation Plan Update | R | Six monthly update (refer ISC 1 August 2017) | | | John Deally |

| Meeting: Infrastructure & Strategy Committee Date: Tuesday 3 April Time: 6.30pm – 9.30pm Venue: Chamber | | | | | |
|--|----------------|--|----------|------------------------------------|-------------------|
| Topic | Type of Report | Description | Duration | External Attendees | Staff Responsible |
| Coastal Management Plan | R | Presentation and feedback on development of the Coastal Management Plan | | Mark Western, Integrated Coasts | Rebecca Neumann |
| Smart Cities Pilot Project Opportunities | R | Discussion on the Smart Cities opportunities, with reference to trends nationally and globally | | | Fiona Harvey |

Draft Infrastructure and Strategy Committee Program 2018

| Meeting: Infrastructure & Strategy Committee | Date: Tuesday 1 May Time: 6.30pm – 9.30pm Venue: Chamber | | | | |
|---|---|---|----------|---------------------------------|-------------------------------|
| Topic | Type of Report | Description | Duration | External Attendees | Staff Responsible |
| Infrastructure Projects Update | R | For noting: Progress updates on key infrastructure projects Update on any emerging risks, significant changes | | | Abby Dickson |
| Funding strategy for 'spade ready' projects | R | Projects ready for implementation; how funding opportunities to be identified/activated; need for a Council public policy statement on how Council funds its projects | | | Tony Lines |
| Export marketing | R | Initiatives to attract new residents, and new business/ commerce/ industry to the City | | | Greg Salmon |
| Economic development | R | Existing and potential location of employment land/industrial districts; Council's role in supporting business and partnering with the Southern Adelaide Economic Development Board; ideas for community energy and technology. | | Potential Tonsley guest speaker | Jason Cattonar Greg Salmon |
| BMX Options | R | | | | Greg Salmon |

| Meeting: Infrastructure & Strategy Committee | Date: Tuesday 5 June Time: 6.30pm – 9.30pm Venue: Chamber | | | | |
|--|--|---|----------|--------------------|-------------------|
| Topic | Type of Report | Description | Duration | External Attendees | Staff Responsible |
| Water | R | Management of stormwater as a key asset; strategies to improve water sensitive urban design | | | Mat Allen |
| Streetscaping/tree management | R | Updates - including reference to application of heat mapping | | | Mat Allen |
| Energy Efficiency and Renewable Energy opportunities | R | Progress of the Energy Efficiency and Renewables Roadmap | | | Ann Gibbons |

Draft Infrastructure and Strategy Committee Program 2018

| Meeting: Infrastructure & Strategy Committee | | Date: Tuesday 3 July Time: 6.30pm – 9.30pm | | Venue: Chamber | |
|---|-----------------------|--|-----------------|---------------------------|--------------------------|
| Topic | Type of Report | Description | Duration | External Attendees | Staff Responsible |
| Capital Construction – Quarterly Update | R | Request from 2 May 2017 meeting | | | Tony Lines |
| Infrastructure Projects Update | R | For noting: Progress updates on key infrastructure projects Update on any emerging risks, significant changes | | | Abby Dickson |
| Sport and recreation | R | Progress of soccer in southern Marion; Mitchell Park Sports and Community Centre | | | Greg Salmon |
| Asset optimisation | R | 5-10 year plan for ownership, management, divestment and procurement within the context of Council's strategic plans | | | Fiona Harvey |

| Meeting: Infrastructure & Strategy Committee | | Date: Tuesday 7 August Time: 6.30pm – 9.30pm | | Venue: Chamber | |
|---|-----------------------|--|-----------------|---------------------------|----------------------------|
| Topic | Type of Report | Description | Duration | External Attendees | Staff Responsible |
| Community issues and opportunities | R | Ageing population; support for physical and mental health | | Potential guest speaker | Fiona Harvey/ Liz Byrne |
| Strategic directions delivery | R | Delivery against Council's strategic directions | | | Fiona Harvey |
| Development of Council's 4-year Business Plan 2019-2023 | R | Initial discussion on key inputs into the development of Council's next 4 year Business Plan | | | Fiona Harvey |

Draft Infrastructure and Strategy Committee Program 2018

| | | | | | |
|---|---|--|-----------------|---------------------------|--------------------------|
| Meeting: Infrastructure & Strategy Committee | Date: Tuesday 4 September Time: 6.30pm – 9.30pm Venue: Chamber | | | | |
| Topic | Type of Report | Description | Duration | External Attendees | Staff Responsible |
| ICT Digital Transformation Plan Update | R | Six monthly update (refer ISC 1 August 2017) | | | John Deally |
| Infrastructure Projects Update | R | For noting: Progress updates on key infrastructure projects Update on any emerging risks, significant changes | | | Abby Dickson |
| Transport | R | How we move people into, out of, and within the City of Marion - public transport; walking and cycling; use of private vehicles; North-South Corridor issues and opportunities; consideration of Council's role in advocacy for better quality infrastructure. | | Potential guest speaker | Mat Allen |

| | | | | | |
|---|---|------------------------|-----------------|---------------------------|--------------------------|
| Meeting: Infrastructure & Strategy Committee | Date: Tuesday 2 October Time: 6.30pm – 9.30pm Venue: Chamber | | | | |
| Topic | Type of Report | Description | Duration | External Attendees | Staff Responsible |
| Oaklands/Marion Cultural Centre Plaza | R | Precinct opportunities | | | Greg Salmon |

| | | | | | |
|---|--|--|-----------------|---------------------------|--------------------------|
| Meeting: Infrastructure & Strategy Committee | Date: Tuesday 6 November Time: 6.30pm – 9.30pm Venue: Chamber | | | | |
| Topic | Type of Report | Description | Duration | External Attendees | Staff Responsible |
| Capital Construction – Quarterly Update | R | Request from 2 May 2017 meeting | | | Tony Lines |
| Infrastructure Projects Update | R | - Progress updates on key infrastructure projects - Update on any emerging risks, significant changes | | | Abby Dickson |

| | | | | | |
|---|--|--------------------|-----------------|---------------------------|--------------------------|
| Meeting: Infrastructure & Strategy Committee | Date: Tuesday 4 December Time: 6.30pm – 9.30pm Venue: Chamber | | | | |
| Topic | Type of Report | Description | Duration | External Attendees | Staff Responsible |
| | | | | | |
| | | | | | |

CITY OF MARION
Infrastructure and Strategy Committee Meeting
3 April 2018

Originating Officer: Glynn Ricketts, Water Resource Coordinator
Manager: Mathew Allen, Manager Engineering & Field Services
General Manager: Tony Lines, General Manager, City Services
Subject: Oaklands Wetlands Water Supply
Report Reference: ISC030418R8.1

REPORT OBJECTIVES

This reports provides an update on the current status, progress and proposed future development for the supply of treated stormwater from the Oaklands Wetlands via the recycled stormwater distribution network.

RECOMMENDATION

DUE DATES

That the Infrastructure and Strategy Committee:

1. Notes the report.

3 April 2018

BACKGROUND

The key objectives of the Oaklands Wetland project were to provide:

- A theoretical maximum injection of 266 ML;
- Up to 172 ML of water suitable for irrigation to Council reserves;
- A high value public open space for the community;
- A bio-diversity vegetation corridor; and
- Community education.

These objectives, with the exception of the supply volumes, have been met. The irrigation of Council reserves and ovals currently uses circa 100 ML per annum (predicted volume for summer 2017/18) and this is expected to reach 120 ML over the next few years.

At present Council is ahead of the planned connection program, supplying Oaklands water to a total of 30 reserves and a further 3 sites will be connected by December 2018. For details on the reserves and the demand volumes refer to **Appendix 1**.

This connection program and the upgrade of aging irrigation systems with new efficient irrigation systems has enabled Council to replace expensive drinking water, historically used to irrigate reserves, with treated storm water.

In addition to irrigating grass to add value to the public realm, Council water trucks use Oaklands water for irrigating and establishing young street trees.

The design intent of Oaklands Wetlands was always to provide an opportunity to supply water to 3rd parties. Both the State and Federal Governments provided funding and a land donation with the knowledge that the site was designed and built to supply water for 3rd party demands. Demand modelling was undertaken that identified the volumes and the potential users of the treated water, for further details, refer to **Appendix 2**.

Surplus water is available, providing Council with an opportunity to recover some operating costs and this opportunity has been realized over the last 2 years, by selling approx. 35 ML of treated water to:

- Various sporting clubs (limited cost recovery);
- The Public Transport Division (Morphettville Depot) for cleaning buses;
- Gateway South consortium for dust control and soil compaction for the Darlington road works.

These sale of water to 3rd parties is possible as a result of the City of Marion holding a minor retail water licence, issued by the Essential Services Commission of South Australia.

DISCUSSIONS

Council established the Water Supply Business in March 2017. Since that time investigations have been undertaken into options to supply surplus water to additional 3rd parties. The most exciting opportunity is the real potential to sell water into the Tonsley Development and supply the proposed development for the Flinders University site. Discussions are advanced between Council, Renewal SA, and the preferred Energy Utility provider for the Tonsley site.

The water demand profile for the Tonsley site increases over time to exceed the current surplus of the Oaklands Wetland, refer to **Appendix 3**. Therefore to improve security of supply in the short to medium term, Council is:

- Reviewing its hydrogeological modelling and risk assessment required by the EPA and Department of Environment, Water and Natural Resources, to increase the scheme from its nominal 500 ML pa capacity to a 700 ML pa, licenced scheme
- Proposing the construction of 3 new injection and extraction wells at the Oaklands Wetlands to increase injection and storage capacity to meet the predicted demand up to 2035 (increase capacity up to a notional 600 ML pa);
- Negotiating with the Energy Provider to contribute a \$1 M (in two \$500,000 increments) to provide the additional wells; and
- Additional funding is then required to increase the treatment capacity of the wetland by an additional 200 ML pa using sand filters to treat stormwater before storing in the aquifer for future re-use (circa 2035) . The funding is to be secured by the sale of water, not sourced from general reserves/rate revenue.

The financial modelling undertaken by all parties justifies the project, although further changes to the model are possible. Significant further treatment costs are incurred by the Energy provider to enable Oaklands water to be supplied for internal building use. In order to sell water at a competitive rate the City of Marion is applying long run marginal cost of supply per K/L to enable the Energy provider to sell water within the Tonsley precinct under the rate charged by SA Water for an equivalent supply.

A firm decision is expected on the supply of Oaklands Water into Tonsley, once the new Government is formed and functional.

FUTURE WORKS

There is another large housing development proposal at Oaklands Park, adjacent to our distribution pipework. The Developers are in discussion with Council over the potential to supply treated storm water into the new housing stock. However, additional water treatment at the Oaklands site is required and the economics of this look marginal. Discussions are ongoing.


Staff have regularly approached DPTI regarding the use of Oaklands water on the Darlington Upgrade project to keep landscaping green. Until recently this has been discounted by DPTI. An irrigation consultant has now been employed and DPTI/Contractor and Councils (Mitcham and CoM) are now actively investigating this potential. This also offers the ability to install a pipe under the Expressway to enable the future of supply of water from the Tonsley Development into the Flinders site.

Discussions have also started regarding the potential to sell water to the construction consortium engaged to deliver the Oaklands Rail corridor project.

A State Government initiative is also underway, called “Adelaide a Water City”. One of the proposals is to investigate an alternative holistic water supply network across the City, where decentralised systems like our Oaklands storm water supply scheme is connected to other schemes to provide a more cost effective, centralised scheme able to cope with regional demand and climatic challenges. Staff are actively engaged in this process.

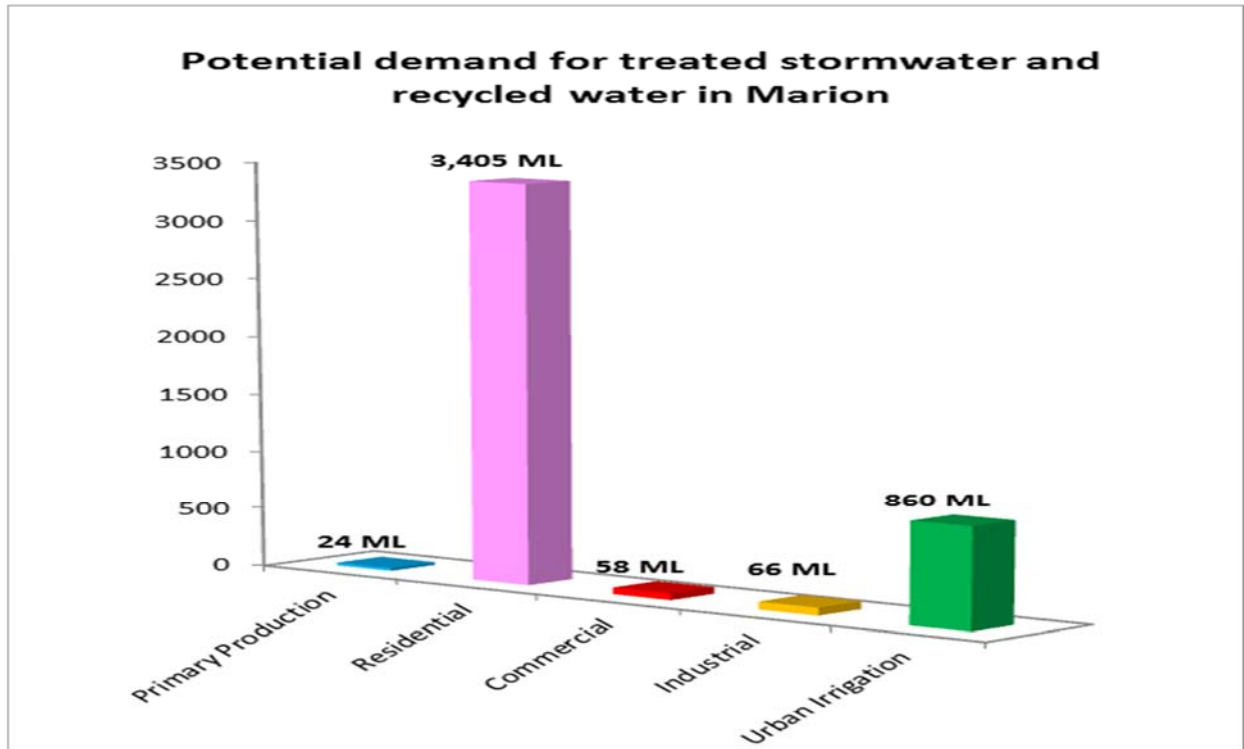
Appendix 1

| Priority | Target Reserve | Opportunistic Reserves* | Irrigation amount ML/a |
|----------|--|-------------------------|------------------------|
| 1 | 1 Marion Swimming Centre and Hendrie Reseve | | 13.1 |
| | 2 Oaklands Wetland | | 4.7 |
| | 3 Oaklands Estate | | 9.8 |
| | 4 Bombay Reserve | | 6 |
| | 5 Kenton Reserve | | 2.7 |
| | 6 Rajah Reserve | | 1 |
| | 7 Mitchell Park Oval and Reserve | | 18.1 |
| | 8 | Alison Avenue Reserve | 1.2 |
| | 9 | Oakleigh Road Reserve | 1.7 |
| | 10 | Quick (Egan) Rd Reserve | 3.1 |
| | 11 | Quick Reserve | 0.7 |
| | 12 CoM City Services | | 1.8 |
| | 13 | Maldon Avenue | 2.7 |
| | 14 | Oliphant Ave Res | 2.7 |
| | | Total - 1 | 69.3 |
| | | | |
| 2 | 15 Marion Bowling Club (not Oval) | | 1 |
| | 16 Marion Leisure Centre (incl Rosedale Ave Reserve) | | 3.3 |
| | 17 Kellett Oval | | 4.8 |
| | 18 | Everest | 2.6 |
| | 19 | Denham | 1.4 |
| | 20 Ascot Park Bowling | | 2.5 |
| | 21 | Parsons Grove | 0.7 |
| | 22 | Park Holme Library | n/a |
| | 23 | South Park Holme Res | 0.9 |
| | | | Total - 2 |
| | | Total 1+2 | 86.5 |
| | | | |
| | | | |
| | | | |
| | | | |
| Priority | Target Reserve | Opportunistic Reserves* | Irrigation amount ML/a |
| 3 | 24 George St Res | | 3.1 |
| | 25 Hazelmere (will be connected 2017 but on G/W) | | 5.6 |
| | 26 | Marion Community House | 1.7 |
| | 27 | Hamilton Park Res | 3.6 |
| | 28 | Chittleborough (Sth) | 2.2 |
| | | | Total - 3 |
| | | Total 1+2+3 | 102.7 |
| | | | |
| 4 | 29 Tonsley Hall (removed) | | 1.1 |
| | 30 Trowbridge & Tartinindi | | 2.3 |
| | 31 Alawoone Ave Res (as Gateway to Mitsubishi) | | 3.3 |
| | | | Total - 4 |
| | | Total 1+2+3+4 | 109.4 |
| | | | |
| 5 | 32 Willoughby | | 5.1 |
| | 33 | Sturt Linear Park | n/a |
| | 34 | Na-Botto | 1.4 |
| | 35 | Appleby | 3.5 |
| | 36 Kendall Reserve | | 1 |
| | 37 Penrith Court | | 0.8 |
| | | Total - 5 | 11.8 |
| | | Total all | 121 |

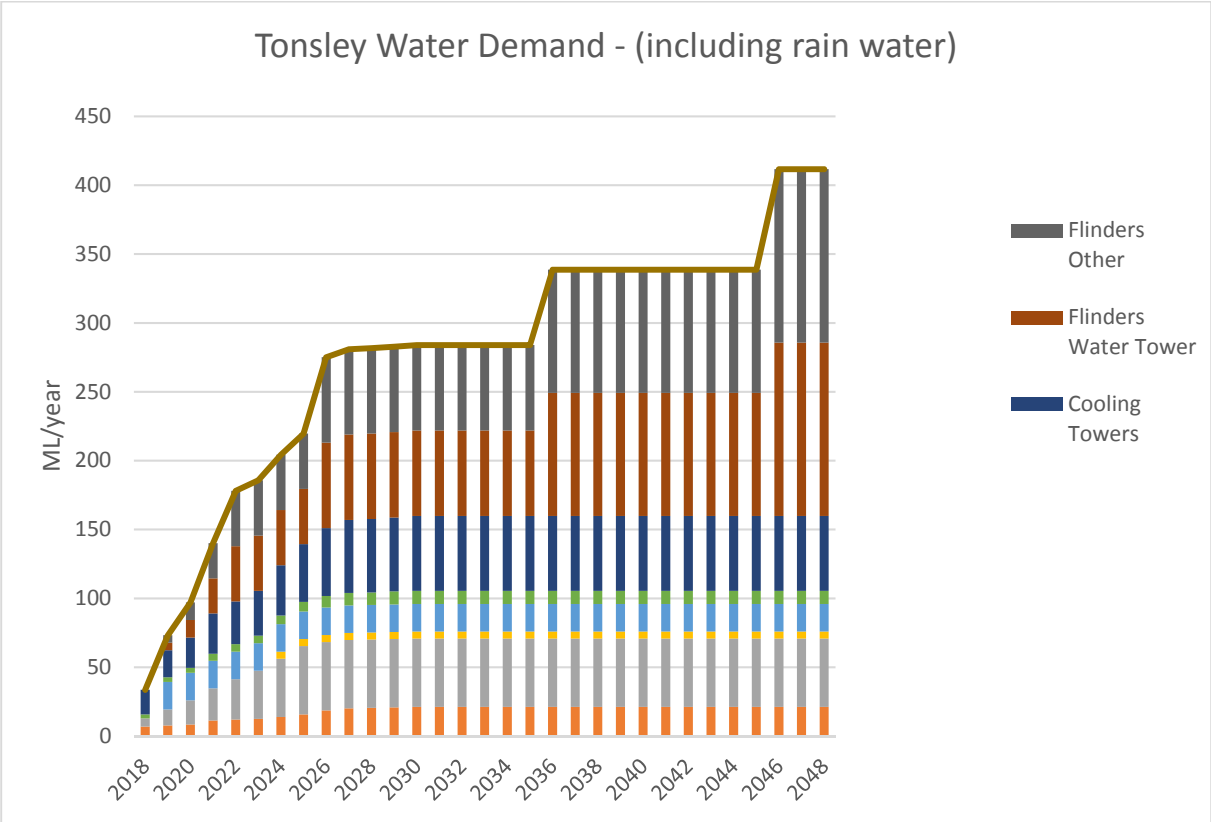
- - Sites currently connected to Oaklands
-  - Proposed connections

Appendix 2

Potential Demand for Treated storm water in Marion



Appendix 3



**CITY OF MARION
INFRASTRUCTURE & STRATEGY COMMITTEE
3 APRIL 2018**

Manager: Fiona Harvey, Manager Innovation and Strategy

General Manager: Abby Dickson, General Manager City Development

Subject: Smart Cities Opportunities

Report Reference: ISC030418R9.1

REPORT OBJECTIVE

The purpose of this report is to provide the Infrastructure and Strategy Committee with an overview of the concept of Smart Cities and:

- Understand the breadth of initiatives being pursued by councils and other agencies across Australia.
- Participate in a workshop to consider the focus areas for City of Marion to further investigate and develop projects/programs.
- Consider partnership opportunities.

RECOMMENDATION

DUE DATES

That the Infrastructure and Strategy Committee:

- | | |
|---|--------------|
| 1. Notes the overview of Smart Cities policy, approaches and programs provided in Appendix 1 | 3 April 2018 |
| 2. Participates in a workshop to consider potential priority opportunities for further investigation | 3 April 2018 |
| 3. Recommends a report be provided to General Council with short priority opportunities for consideration of funding from 2018/19 | May 2018 |
| 4. Notes a draft framework/roadmap will be presented to the Infrastructure and Strategy Committee for further consideration | June 2018 |

BACKGROUND

The concept of 'smart cities' is growing with the help of various Smart City initiatives led by all levels of government along with private and education sector organisations, often in collaboration.

Smart Cities is a broad term that is defined differently by different organisations. At a simple level it is the idea of incorporating technology to create a better connected city and to improve the lives of our community.

The fundamental philosophy of the smart cities 'revolution' is that it is built on technology, but focused on outcomes.

Most organisations are progressing smart cities opportunities across a range of outcome themes, for example:

- Business efficiency and connectivity
- Sustainability
- Health and wellbeing
- Mobility
- Economic development
- Safety
- Buildings and infrastructure

The fact that a 'Smart City' lens can be applied across almost all areas in which local government has a stake provides both great opportunity, but also a challenge to determine the key priorities that will provide the best outcomes for its community.

A synopsis of Smart City policy, research and approaches is provided in Appendix 1.

The City of Marion has committed to targeted Smart City opportunities through its 2017-2027 Strategic Plan and its 2016-2019 3 year business plan, particularly in areas relating to using technologies to improve efficiency and service delivery, operating more sustainably, sharing information and connecting with our community and using data to provide evidence and support decision making. However, there is opportunity to progress Smart City principles and actions across all of the six themes of our Strategic Plans, and across the short term and medium-longer term.

A range of projects and programs are already in progress that align with the Smart City definition. A summary of these projects aligned to our Community themes is provided in Appendix 2.

DISCUSSION

City of Marion's Community Vision towards 2040 and Strategic Plan 2017-2027 provide a framework for considering Smart City opportunities. The 6 themes, their long term vision and 10 year goal are summarised below.

| Theme | Towards 2040 Vision | 10 Year Goal |
|----------------|--|--|
| Liveable | By 2040 our city will be well planned, safe and welcoming, with high quality and environmentally sensitive housing, and where cultural diversity, arts, heritage and healthy lifestyles are celebrated | By 2027 will be have attractive neighbourhoods with diverse urban development, vibrant community hubs, excellent sporting facilities, open spaces and playgrounds |
| Valuing Nature | By 2040 our city will be deeply connected with nature to enhance peoples' lives, while minimising the impact on the climate and protecting the natural environment | By 2027 we will improve stormwater management, increase energy efficiency, promote biodiversity and improve opportunities for people to play in open spaces and interact with nature |

| | | |
|------------|--|--|
| Engaged | By 2040 our city will be a community where people are engaged, empowered to make decisions, and work together to build strong neighbourhoods | By 2027 our community will feel engaged and empowered to influence the improvement of their own neighbourhood |
| Prosperous | By 2040 our city will be a diverse and clean economy that attracts investment and jobs, and creates exports in sustainable business precincts while providing access to education and skills development | By 2027 we will be constantly read to adapt to technological advances. We will be better and quicker at sharing relevant information |
| Innovative | By 2040 our city will be a leader in embracing and developing new ideas and technology to create a vibrant community with opportunities for all | By 2027 our city will see realisation of the full potential of the Tonsley Precinct and other key commercial –industrial-retail zones |
| Connected | By 2040 our city will be linked by a quality road, footpath and public transport network that brings people together socially, and harnesses technology to enable them to access services and facilities | By 2027 it will be easier and safer to move around our city which will have accessible services and plenty of walking and cycling paths. New technology and community facilities will better connect our community |

Each of the commonly used themes across the globe to present Smart Cities approaches, framework and strategies align well with City of Marion's themes, however the inclusion of a Business/Organisational efficiency theme is also proposed to ensure a focus on our organisation improving efficiency and service delivery outcomes using technology.

The proposal is to develop a Smart City Framework/Roadmap using the themes of the Community Vision, with the addition of a Business efficiency theme, to ensure the focus of the Smart City approach will progress the goals and vision of the community, and respond to a priority issue or opportunity, rather than install technology for the 'sake of it'.

Potential Opportunities for City of Marion

2018/19 provides an opportunity for City of Marion to develop and pilot a number of Smart City projects. The benefits of smaller scale pilots include:

- better understanding the technology available and what works best in different situations
- working through the key parameters around ownership and management of elements such as connective networks, infrastructure such as sensors, data, dashboards etc
- engaging with a range of partners
- relatively fast turn-around to enable us to use the data and information quickly to inform decisions
- better understanding risks, timeframes, cost and benefits for full scale roll out

Five projects are proposed to be scoped and implemented in the short term (1-2 years):

| Proposed Project | Outcome |
|---|--|
| Monitoring of Playground usage, using sensor technology | Comprehensive data on the use of playground sites to inform decision making on investment in playgrounds |
| Oaklands Crossing and surrounds as a Smart City precinct | Embedding Smart technology in the Oaklands precinct to provide an improved community experience, connectivity, and business/economic opportunities |
| Small scale smart LED lighting trial | Better understand the opportunities, risks and impacts of smart infrastructure and lighting at a precinct/neighbourhood level |
| Urban activation precinct monitoring, using sensor technology | Comprehensive data on the before and after use of the urban activation sites to help measure the impact of the activation program |
| Tonsley as Australia's leading Smart City hub | Feasibility analysis of the residential development and innovative business opportunities at Tonsley to develop the site and surrounding areas as a Smart City hub. Use the site as a 'test bed' for smart technology |

Collaboration and Partnerships

Collaboration and partnerships will be critical to the success of any Smart City project. The City of Marion is situated well to take advantage of the innovative businesses and education centres in the Tonsley district. Initial meetings, tours and discussions have occurred with businesses including SAGE Automation, NexGen Lighting solutions, Micro X portable X-ray business, Zen Energy and Spiral Data Group all based at Tonsley.

Given the rapidly developing and expanding profile of Smart Cities, there are many businesses and providers who are establishing themselves as potential partners in the field. The opportunity to partner with some of these entities through the pilot/short term projects will enable City of Marion to test their services, expertise and approaches before determining the best model to move forward with.

City of Marion is working in partnership with Flinders Uni and its New Venture Institute across a range of programs, providing a valuable opportunity to strengthen partnerships in Smart City initiatives. This will be further explored once feedback is provided by the Committee and Council on its priorities over the short and long term.

The Southern Adelaide Economic Development Board has identified and prioritised the importance of being a Smart Region in its Strategic Plan. They have also been facilitating discussions with key business and government leaders to understand the opportunities for the region.

Workshop Questions

To progress the development of a Smart City Framework and a suite of short term projects, it is proposed the Committee participate in a workshop to consider the following questions:

Is the Committee supportive of using the 6 Community Vision themes as the framework for the development of City of Marion's Smart City Roadmap?

What are the key considerations in developing and implementing Smart City projects?

Is the Committee supportive of the short term (1-2 years) project opportunities proposed?

What are the medium-long term (3-5 years) opportunities for Smart City projects?

NEXT STEPS

Using feedback from the I&S Committee, a report will be prepared for Council to consider the short term priorities, particularly those requiring funding in 2018/19. In parallel a Smart City framework/roadmap will be developed in preparation for presentation back to the Committee in June 2018.

Throughout this process, internal engagement with all key areas will continue to better catalogue and govern the projects and programs that are aligned to our Smart City framework.

SPEAKER

Fiona Harvey, Manager Innovation and Strategy
Adam Gray, Smart City Consultant

ATTACHMENTS

Appendix 1: Smart City Policy, research and approaches

Appendix 2: City of Marion current and potential short term projects

Appendix 1 -Smart Cities Summary

Below is a snapshot of Policies and approaches relating to Smart Cities being progressing across Australia.

1. Australian Government Focus

The Australian Government launched a Smart Cities Plan on 29 April 2016 aiming to build an agile, innovative and prosperous nation. The Plan is based on the Government's contention that as Australia's economy continues to transition and as knowledge industries grow, then to take advantage of tomorrow's economic opportunities there is a need to rethink the way our cities are planned, built and managed today. The full Plan can be viewed or downloaded at <https://cities.dpmc.gov.au/smart-cities-plan>.

In building the cities of tomorrow, three pillars are identified in the Plan:

Smart Investment

This is defined as:

- Prioritising projects that meet broader economic objectives
- Treating infrastructure funding as an investment wherever possible
- Getting involved early to ensure rigorous planning and business cases
- Increasing investment.

Smart Policy

All levels of government contribute to the development of our cities and their needs an acceptance by all levels of government that a strategic approach is necessary – one that identifies clear, unambiguous processes, timeframes and accountabilities for city level reforms. Smart Policy will be required for:

- Delivering 'City Deals' (better outcomes through coordinated investment)
- Leading regulatory reform
- Measuring success (identification of key city metrics and data).

The Plan gives an example of a UK city deal featuring Manchester, which involves 10 local governments collaborating with a focus on investment, business support, skills, transport, and housing and reduced carbon emissions.

Smart Technology

This means:

- Thinking of technology solutions first
- Leveraging open and real time data
- Driving use of energy efficient technologies.

To support the Smart Cities Plan, the Government established a competitive Smart Cities and Suburbs Program worth \$50 million which supports local governments to fast track innovative technology solutions that improve long standing urban problems. The first round of the Program was implemented in 2017, with approximately half the funding made available for bids. 176 applications were received, and 52 projects were funded including 6 projects in SA.

The City of Marion submitted a proposal in partnership with City of Charles Sturt for funding to implement 'smart' technology in conjunction with the roll out of the transition to LED lighting project but were not successful in winning funding for the program (successful bids tabled below). A second round of funding is expected to be announced in early 2018.

South Australia

| Project Title | Lead applicant | Project location | Grant Amount | Co-contribution | Total |
|---|----------------------------------|--|--------------|-----------------|-----------|
| Heywood Park Smart City Precinct | Corporation of the City of Unley | Heywood Park Unley, SA | \$240,000 | \$240,000 | \$480,000 |
| Smart Access to Community Services, Mid Murray Region | Mid Murray Council | Mid Murray Region, SA | \$195,426 | \$353,854 | \$549,280 |
| Smart Tourist Town, Kapunda | Light Regional Council | Kapunda, SA | \$159,224 | \$840,000 | \$999,224 |
| Connected Cities, Prospect | City of Prospect | City of Prospect, City of Burnside, City of Port Adelaide Enfield, City of Playford, Campbelltown City Council areas of SA | \$144,900 | \$145,000 | \$289,900 |
| Smart Active Transport, Port Adelaide | City of Port Adelaide Enfield | Port Adelaide, SA | \$100,000 | \$100,000 | \$200,000 |
| Connecting Communities in Alexandrina | Alexandrina Council | Goolwa, Ashbourne, Strathalbyn, Port Elliot, Langhorne Creek, Milang and Mount Compass, SA | \$100,000 | \$154,920 | \$254,920 |

2. Australian Smart Communities Association - www.australiansmartcommunities.org.au/

The Australian Smart Communities Association was established in 2013 initially based in Queensland as an organisation to provide leadership in the advancement of smart communities across Australia and aims to share information and advocate for the resources to assist the localised transition to a digital economy.

The Association's definition of a Smart Community is one that uses information communication technologies and data to be more efficient. They enjoy cost and energy savings, improved service delivery, better quality of life and a reduced environmental footprint. They support innovation and the global economy. Smart communities advocate for the integration of technology and data infrastructure, promote digital technologies to increase the capability of existing infrastructure and services, and champion citizen involvement and citizen-focused service delivery.

It is a membership organisation made up of local governments, Regional Development Australia committees, regional organisations of Councils, industry, businesses and individuals. It currently has three members in South Australia; Adelaide City Council, Prospect Council and the Eastern Region Alliance.

3. South Australian Government

The South Australian Government does not have a targeted Smart City Policy or Strategy, however is focused strongly on innovation, digital transformation and entrepreneurship.

Tom Hadju has been appointed as the State's Chief Advisor on Innovation, with his role focused on continuing to collaborate with government leaders and stakeholders and support the State Government's policies and programs in attracting national and international entrepreneurs to South Australia. He will also ensure the state takes advantage of major growth opportunities in the digital economy and create the high-tech jobs of tomorrow.

SA Government is also working closely with Adelaide City Council, research organisations and technology providers to provide infrastructure and connectivity across the city to make the city more innovative and attract new businesses to the state. The GigCity project aims to make Adelaide in South Australia one of the most connected cities in the Southern Hemisphere, creating a new era in digital connectivity. It also has Australia's first Internet of Things innovation hub – Adelaide Smart City Studio – and Cisco's first and only 'Lighthouse City' in Australia <http://gigcity.com.au/why-adelaide/>

The South Australian State Government has also partnered with French global Internet of Things (IoT) provider Sigfox to deploy its communications network across South Australia. Sydney based company Thinextra will deploy the infrastructure. Sigfox provides a low cost, low bandwidth, long range public IoT network. This network will facilitate the connection of a myriad IoT devices including, alert systems (fire/flood/drainage), wayfinding, and traffic/parking systems.

4. LGA SA

The SA Local Government Association recently partnered with the University of Adelaide to undertake a 'snapshot' of the current state of Smart Cities across the SA Local Government sector. The snapshot was undertaken through phone and paper surveys, seeking feedback from all councils on that current involvement in Smart Cities. The report (attachment 1) provides an overview of the insights through the study.

5. Case Studies

There are a wide range of differing approaches to the development of a Smart City both within and outside Australia. Major, capital and provincial cities lead the way in embracing Smart City solutions focused heavily on the leveraging of technology to lift business attraction, economic investment and capital city opportunities. Some examples are provided below:

Adelaide City Council

<https://www.cityofadelaide.com.au/city-business/why-adelaide/adelaide-smart-city>

Adelaide City Council is pursuing a number of projects with the goal of establishing Adelaide as a Smart City with the view that such as city is one that uses technology to transform its infrastructure and make better use of energy, resources and services. These projects include:

- The provision of Australia's first 10Gbps fibre optic network
- The establishment of the city wide free Wi-Fi network with the South Australian Government
- Opening of its Smart City Studio
- Smart lighting project in Pirie Street and Hindmarsh Square
- Smart Environmental Monitoring and Smart Parking projects
- Smart bins

Sunshine Coast Council - <https://www.sunshinecoast.qld.gov.au/smartcities/>

In late 2014, Sunshine Coast Council partnered with Cisco and Telstra to develop a smart city framework for the Maroochydore City Centre Priority Development Area and the wider Sunshine Coast Region.

A portfolio of 13 value added services were identified for staged implementation and include projects such as fibre optic network services, smart lighting, smart city Wi-Fi etc.

Projects currently established are:

- A Living Lab in Caloundra testing and trialling smart technology solutions such as lighting and parking before they are gradually installed across the region
- A Smart Centre in Caloundra to allow residents and businesses to see real-time results from the Living Lab
- A Smart App giving providing Council information on events and road closures etc.

Parramatta City Council - <https://www.cityofparramatta.nsw.gov.au/our-sites/smart-city>

Parramatta released its Smart City Masterplan in August 2015 with the vision that Parramatta will be a Smart City that leverages the foundations of good urban planning, transparent governance, open data and enabling technologies that will underpin our position as a vibrant, people-centric, connected and economically prosperous city. The Council have adopted a definition of a Smart City as a city based upon the foundations of good urban planning, economic competitiveness, environmental engineering and sustainable practices that uses information and communication technologies to enhance liveability, sustainability and workability. It has appointed a Strategic Smart City Officer to implement this city-wide initiative.

Over 50 projects, programs and initiatives have been identified and in the process of implementation including:

- Free Wi-Fi, currently available in six libraries and part of the CBD
- Hackathon meetups using government data sets
- 3D printing studio meetups
- LED street-lighting is being progressively rolled out
- 50 Solar powered wireless CCTV cameras
- Various smart apps and online initiatives.

Brisbane City Council - <http://www.digitalbrisbane.com.au/>

The Lord Mayor of Brisbane launched the Digital Brisbane Strategy in 2012 with the aim to kick start a business revolution ensuring that the city capitalises on the rapidly growing digital economy. Five year targets were set to double the number of local businesses selling products and services online, a 35% improvement in productivity growth achieved through digital technology and support for 250 promising local digital start-up companies.

Beyond Capital and Regional Cities, many councils are developing Smart City Strategies, Digital Transformation Plans and Future visions to capture the principles, goals and actions for smart cities. Unfortunately there is limited information on publically available websites for some of these projects

City of Darwin - <https://www.darwin.nt.gov.au/council/news-media/news/switching-on-darwin-with-5million-for-cctv-smart-lights-wifi-and-parking>

The City of Darwin has been awarded a \$5 million Australian Government technology grant to 'switch on' the city and take forward an economy-boosting Darwin City Deal.

Darwin's *Smart Technology Project* has been announced as one of 52 successful projects totalling \$28.5million under Round One of the Australian Government's inaugural *Smart*

Cities and Suburbs Program. Under the Program, funding will flow to communities across Australia, with 40% of successful projects located in regional areas.

The City of Darwin will partner with the Northern Territory Government to install CCTV cameras at entrances to the city, along Daly Street and Bennett Street. Street lighting will be upgraded to LED lighting and on 'smart' columns with the capacity to adjust lighting to reduce street crime. In Bicentennial Park, smart lighting will include sound monitoring to detect people in distress and potentially notify police and emergency services. The free Wi-Fi network will be expanded in key tourist and shopping areas. Smart parking sensors will indicate available parking and reduce congestion and emissions.

6. South Australian Metropolitan Councils

Information on SA Metropolitan Councils is difficult to find via public websites.

Leading examples in SA include:

- Town of Gawler, City of Prospect (main street and business hub approach)
- City of Unley (smart park/precinct) <https://www.unley.sa.gov.au/city-planning-initiatives/major-projects-initiatives#heywood-park-smart-technology-481>
- City of Charles Sturt (smart precincts and trials with parking and waste collection). Are also releasing a draft strategy for community consultation (attachment 2).
- City of Holdfast Bay (particular theme – smart parking and transport)
- City of Playford – deployment of Lora WAN community-based communications network



An aerial photograph of a dense urban landscape, likely Tokyo, featuring numerous skyscrapers and residential buildings. Overlaid on the image is a complex digital network of white lines connecting various nodes. Several circular icons are placed at key nodes: a smartphone, an airplane, a location pin, a Wi-Fi signal, a mail envelope, a computer monitor, and a shopping cart. Large, semi-transparent circular patterns resembling signal waves or data orbits are centered around some of these icons, particularly the Wi-Fi and mail icons, enhancing the theme of digital connectivity and smart infrastructure.

seek LIGHT

Further Information

Dr Graciela Corral de Zubielqui
Associate Head (Research) ECIC
Project Management and Innovation
Entrepreneurship, Commercialisation and Innovation Centre - ECIC
Level 9, Nexus 10 Building
Cnr Pulteney St and North Terrace
The University of Adelaide
Ph : +61 8 8313 7491
graciela.corraldezubielqui@adelaide.edu.au

Project Team

Dr Graciela Corral de Zubielqui
Doctor Cate Jerram
Associate Professor Nickolas Falkner
Doctor Steve Kern
Ashkan Zarghami

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Foreword

Adelaide is a remarkable city. The fifth largest city in Australia, geographically constrained by hills and ocean, it does not have the age or wealth of some of the larger cities, nor the trade advantages of being a seaport on the Northern or Western coasts. And yet it is regularly rated as one of the most liveable cities in the world, with recent large-scale technological and industrial successes. Given its size and location, Adelaide must be innovative, agile, and forward-looking if it is to thrive, economically and socially. The Australian Smart Cities Consortium was founded to drive engagement between University, all levels of Government, industry and entrepreneurs, because we have a strong belief that Adelaide's structure, history, and character can all contribute to South Australia becoming a significant innovator in the smart cities space.

This report is based on a snapshot of councils from the Metropolitan Local Government Group, commissioned by the Local Government Association of South Australia, developed through survey and interview. While much of what is in here is not overly surprising, there are details that resonate and give guidance for the strategies that could be used to develop more smart cities initiatives and provide better support to those already in play.

The researchers were impressed by the knowledge, passion, and commitment of the employees that they spoke to across the councils and it is clear that Adelaide's Metropolitan Councils have been investing into this exciting new opportunity, with some excellent results.

Adelaide is far more advanced in this initiative than most people realise and we are producing world class work in many smart cities-related areas. All that remains is to move pilots to production, widen our levels of collaboration and data sharing, and to openly talk about the excellent things that are already taking place, if we are to take a place on the World stage.

Associate Professor Nickolas Falkner

Director of the Australian smart cities Consortium at the University of Adelaide

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“A SMART CITY IS A CITY THAT USES TECHNOLOGIES TO MAKE LIFE EASIER FOR ITS CITIZENS.”

Smart City Perspective

1. Introduction

Cities around the world face a number of challenges linked to worldwide trends, such as growing competition, budget constraints and climate changes, to name a few. According to the Australian Bureau of Statistics (ABS), as of 2016, 67% of Australians live in Australia's eight capital cities. The ABS predicts that this will increase to 72% by 2053. This rapid and often unplanned urbanisation coupled with the abovementioned challenges poses risks to critical infrastructures and social stability. Even where citizens are not actively moving into cities, they are often required to interact with city services, effectively becoming virtual inhabitants and placing increasing demands upon the infrastructure of government. At a time when public service workforces are often shrinking, this increase in work and demand can present challenges to even the most efficient and effective council.

To tackle the challenges faced by our cities, it's clear that smarter ways need to be developed to manage the situation. Urban planning and management has evolved to a comprehensive vision, embracing these new technological innovations. As a result, the concept of a smart city has emerged as a complementary approach to contemporary urban planning and management. Today, the smart city is a phrase seen frequently on the urban strategy agendas of governments across the world, and smart cities are being piloted across the world.

This report provides a snapshot of the smart city activities across the Metropolitan councils of Adelaide to help local government authorities make informed decisions for smart city implementation strategies.



2. Smart City Definitions

The term “smart city” can be interpreted in different ways and there is no universally accepted definition of a smart city, although many are currently in use. The following are some examples.

- A smart city is a city that adopts Information and Communications Technology (ICT) in order to enhance its liveability, workability and sustainability (smart cities Council, 2013).
- A smart city is a city where the conditions of all its critical infrastructures are monitored and integrated (US Office of Scientific and Technical Information).
- A smart city is an instrumented, interconnected and intelligent city (IBM, 2010).
- A smart city is a city seeking to address public issues via ICT-based solutions on the basis of multi-stakeholder and municipality-based partnership (European Parliament, 2014).

- A smart city is a city that links physical and social capital in order to enhance the quality of services (Corriea and Wunstel, 2011).
- A smart city is one that is able to integrate the physical, IT, social and business infrastructures into a single framework so as to leverage the collective intelligence of a city (Harrison et al., 2010).
- A city is smart not only in terms of the way that we can automate routine functions but also in terms of ways that enable us to monitor, understand, analyse and plan the city to improve the efficiency, equity and quality of life for its citizens (Batty et al., 2012).

Although a common definition of the smart city concept has not been found yet, the aforementioned definitions all emphasise improving the quality of life through the use of new technologies in all city management, its services and its infrastructure.

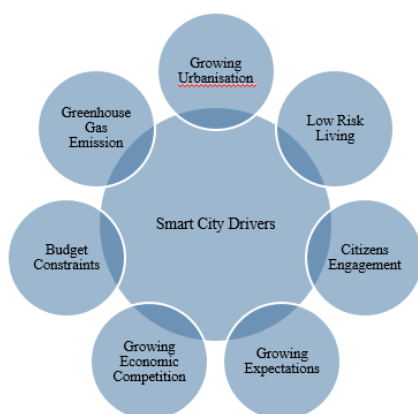
On this premise, we here define the smart city as:

“A city that uses technologies to make life easier for its citizens”,

indicating the critical balance between new technologies and social factors.

3. The Drivers of Smart Cities

Smart city projects around the world have a range of drivers. These include:.



3.1. Growing urbanisation

According to a 2014 UN study of global residency, 54% of the world population lives in urban areas. This is anticipated to increase to 66% by 2050. This can be ascribed to the many benefits that cities can provide, including greater access to health care and education, greater employment opportunities and greater access to entertainment, culture and art.

3.2. Low risk living

The concentration of more people in an area means that localised threat can have greater impact. People living in cities are vulnerable to life threatening events such as floods and storms, bushfires, air and water pollution, and recently terrorist attacks. Smart city solutions can provide continuous access to relevant data and therefore create early warning systems which in turn enables a timely administration intervention to reduce these risks.

3.3. Citizens' empowerment and engagement

Through smart cities approaches, leaders and representatives can provide citizens with opportunities and access to information. This, in turn, allows citizens to participate meaningfully in the development of and decision-making about the city. The smart city can offer an integrated, personalised citizen portal for urban services which helps to develop a continuous, two-way communication with citizens, and thereby empower them to engage in city governance

3.4. Growing expectations

Citizens' expectations are steadily rising as their personalised access to information and services increases. They expect the same pattern to occur for urban services, including more efficient government services, high-bandwidth communications, and efficient transportation.

3.5. Growing economic competition

The world is witnessing a new era of economic competition, where cities are competing with each other to achieve greater quality of life for

3.6. Budget constraints

3.7. Increased greenhouse gas emission

Greenhouse gas emission is the most significant driver of observed climate change. Developing sustainability strategies for energy consumption, transportation, urban planning and eco-friendly buildings plays a pivotal role in reducing greenhouse gases.

4. Smart City Objectives

The overarching objective of the smart city solution is to provide the best quality of life for all citizens, while minimising the consumption of energy and resources. Economic factors have to be considered as part of this, given the focus on resource optimisation. Specific objectives of the smart city initiative are as follows:

- Giving citizens an active role by involving them in community decision-making and promoting health and safety.
- Increasing the efficiency of transportation system.
- Increasing government-to-citizen and government-to-government digital communication.
- Creating a sustainable and greener city.



5. Smart City Dimensions

In this section, we present the specific aspects of a city upon which the smart city initiative can be developed.

5.1. Smart mobility

While many use the term “transport” in this context, transport assumes a vehicle of some sort and many cities can be navigated on foot or are associated with initiatives to increase foot traffic. Smart mobility, enhanced urban movement of any kind, fosters faster, cleaner, greener, cheaper and more efficient transportation of people, goods and data. It reshapes traditional urban mobility by adopting what is already available and also making use of new technologies to gather and provide information and services to citizens and planners. Smart mobility changes the way people travel within cities and improves a city’s liveability, workability and sustainability.

5.1.1. Smart parking

Smart parking solutions leverage car parking technology hardware, software and associated products and services in order to provide a more efficient parking system. It can facilitate identifying free parking spaces, sending signals when the car park spaces are available, thereby enabling sustainable transportation.



Smart parking also offers a wide range of technology services such as cashless payment and smart permit parking.

5.1.2. Smart traffic lights

Smart traffic lights eliminate structural traffic problems and enable cars to travel with minimum delays. This reduces traffic and congestion, improving public safety.

5.1.3. Smart bike path

A smart bike path provides cyclists with “intelligent” assistance, resulting in better safety, convenience and fun on any trail or bike.

5.1.4. Driverless bus/car

Autonomous vehicles (buses/cars) navigate using sensors, lasers and GPS systems. Driverless buses are able to pick up passengers upon request from their location through an app. The self-driving system significantly minimises costs in low density suburbs where public transport providers struggle to supply regular services.

5.1.5. Smart electric and hybrid cars

Smart electric and hybrid cars are being recognised as an exciting green advancement for sustainable development of cities. Driving these cars increases fuel efficiency and reduces the environmental impact.

5.1.6. Smart active transport

Smart active transport reinforces cities with safer, faster and more efficient means of travel and offers more travel options such as cycling, walking, scootering and public transport.

5.2. *Smart urban services*

Emerging technologies are changing the way urban services are delivered. Smart city solutions create a movement in urban services that will make these services instant, sustainable and conveniently available anytime, anywhere.

5.2.1. Smart waste

A smart waste collection solution provides waste bins with intelligent monitoring, allowing rubbish level in containers to be measured. This in turn has a positive effect on collection frequency, reduced labour costs and optimised collection routes for workers.

5.2.2. Smart lighting

Intelligent, weather adaptive street lights reduce power consumption and carbon footprint and increases citizens’ safety and security.

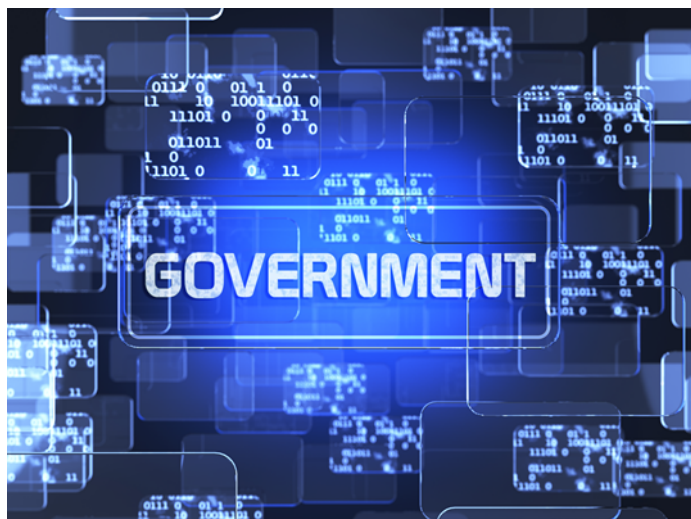


5.2.3. Smart parks and gardens

Parks management can benefit from smart city technology by increasing efficiencies, because the same number of staff can look after more parks. Smart parks and gardens solutions also decrease lighting expenditure by implementing smart floodlight control systems. It also saves on water consumption through the use of a smart park irrigation controller.

5.3. Smart government

Smart government creates a platform with more communication channels between different stakeholders, citizens and city councils in the sub-dimensions of smart administrative services, smart payments and smart data sharing.



5.3.1. Smart administrative services

Smart administrative services create new streams of data that reduce the operational costs and administrative overheads, speeding up the process of serving citizens. The implementation of smart administrative services results in more transparency and trust.

5.3.2. Smart payment

Smart payment serves as a bridge between payers (citizens) and the payee (city council) to address security, interoperability and speed issues. By leveraging new technologies, councils can offer many potential benefits for urban services such as: automated payment systems in the case of pay-by-weight waste collection, getting real-time access to suppliers' database, and historical price comparison through the use of an e-procurement platform.

5.3.3. Smart data sharing

Collaboration between city councils can provide important benefits to councils and citizens by way of additional expertise, support, greater

efficiency and less duplicated effort. Smart data sharing facilitates collaboration among different city councils, government entities, private sector companies and citizens.

5.3.4. Smart Business Services

Smart business services, such as business incubators, focus on early stage companies and provides them with the opportunity to commercialise their ideas. Smart business services enable a new company to connect with other businesses and governments by means of providing access to programs and grants.

5.4. Smart citizens

The central pillar of each smart city is its citizens. The successful future of smart cities requires a citizen-centred approach in which all decisions and services are designed with citizens in mind. Therefore, understanding citizens' needs and challenges is the first step in developing smart city solutions.

5.4.1. Smart access to community services

Councils provide a range of support services and facilities to assist individuals and groups in their municipality. Smart access to these services promotes a fair, transparent and an open city council for residents.

5.4.2. Tourism and major events

When a city pursues a smart city approach, visitors can benefit from lower costs for visiting the city, as well as improved mobility. Smart cities can offer visitors an enhanced experience by suggesting itineraries and providing interactive maps and audio guides, and creating a welcoming atmosphere.

5.4.3. A civic app

Leveraging mobile apps enriches the quality and interactivity of urban services. Mobile apps empower communities in more intelligent ways and provide the ideal foundation for many smart city solutions by offering a high level of engagement and real-time interaction. Some important considerations to support possible applications include:



Support: Social network

Cities can use social media to connect visitors and residents with the city, offering a wide range of services such as finding community events, real-time reporting of issues, offline navigation, and delivering traffic and weather alerts. In essence, using social media platforms improves communication and speeds up the services provided by city councils.

Support: NBN, public Wi-Fi and Internet

Connectivity is the backbone of smart cities both for internet access and new digital services. NBN and public Wi-Fi provide an amenity for residents and enable IoT-based city services. With the rise of the Internet of everything, public Wi-Fi supports a range of smart city initiatives which will benefit citizens.

5.4.4. Digital hub

A digital hub offers a social environment where residents can develop the skills needed to survive in the digital age. A digital hub provides an opportunity for citizens to learn how to use ICT and work on digital media.

5.4.5. Smart library

Reading is considered to be the most important gateway to gain knowledge and information and it is the cornerstone of civilization. The smart library enables users to conduct searches on various subscriptions and online resources and access full text articles.

5.4.6. Citizen involvement

Citizen involvement is a key element of most of the definitions of smart cities presented earlier. On one hand, citizen involvement ensures citizen satisfaction. On the other hand, it entails the efficiency of the smart city initiative.

5.4.7. Smart lab

A smart lab is a space to prototype and test city services with the community, providing citizens with an opportunity to explore creativity through a wide variety of experiences and technologies. Additionally, smart labs can host community events and workshops aimed at sharing and exploring ideas.

5.4.8. Promotional marketing

Technology is at the forefront of marketing and promotions. Smart promotional marketing can create a new income stream for city councils through the mechanism of public-private partnership and the use of smart city facilities. It is important for councils to work in partnership with local businesses to encourage greater innovation and creativity to assist existing businesses to expand and to encourage new business ventures to relocate in the city.

5.5. Smart buildings

There are many benefits in establishing and enforcing new requirements for making buildings “smarter” by using sensors, meters, systems and software to monitor a wide range of building functions. Such benefits include improving occupant comfort, energy efficiency and carbon footprint reduction, yielding a return on investment for owners, increased security, and reduced maintenance costs.

5.5.1. Smart infrastructure

The growing population is putting increased pressure on ageing infrastructure such as drainage systems and roads. Smart solutions facilitate the effective management and maintenance of core infrastructure, and enhances asset management practices.

5.6. *Smart environment*

Concerns about the environment are often central in the quest for developing smarter cities. Cities are the main consumers of energy and producers of greenhouse gas, thereby facing enormous environmental challenges. Even the use and management of water is an enormous challenge by itself. Using new technology and innovations in smart cities will enable them to meet legislated environmental targets.

5.6.1. Environmental signage

A smart city with embedded sensors, displays and computing devices enables citizens to control their environment. Intelligent environmental warning systems, such as real-time display of UV index and real-time air-pollution levels, alert the public of impending environmental threats.

5.6.2. Electric car charging stations

In a smart city, every electric vehicle must have access to a charging station within its driving range. Installing electric car charging stations in the city maximises convenience for electrical car drivers, which powers the future of sustainable mobility.



5.6.3. Renewable energy

Buildings and transport are the two largest energy consumers in cities. Thus, deploying renewable energy technology is pivotal for sustainable development. In the last few years, many Australian city councils have initiated programs that can be classed as focussed on “Renewable Energy” in order to reduce carbon emissions and save energy. Renewable energy is available in the form of solar panels for council owned buildings as well as commercial and residential buildings.

5.7. *Smart public health and safety*

Public health and city safety is at the core of every smart city deployment. The aim of smart public health and safety is to protect and promote healthy life choices for its citizens.

5.7.1. Incident management

Establishing a city-wide approach to enable the whole community to work together to manage all threats and hazards is a prime objective of an incident management system. In recent years, integrated real-time emergency events models and warning information management systems have been leveraged by city councils across the world, for incidents such as bushfires, flooding, and malicious attacks.

5.7.2. Security services

Security is an integral part of developing smart city initiatives. The aim of security services is to monitor and manage physical assets, infrastructure, connectivity, and information services that affect citizens on a daily basis. The overall priority must be to build the residents’ trust and confidence in their security as well as accepting services provided by smart cities. Surveillance systems and equipment, video analytics, cybersecurity, data and command centres are all components of a safe smart city.

5.7.3. Smart health and human services

Smart health and human services attempt to leverage new technologies to create a more

inclusive and skilled community. This helps to improve citizens' quality of life by focusing on vulnerable people including senior residents and homeless people.



Smart aged care

As Adelaide is experiencing a demographic shift, the need for an aged-friendly city is now more pronounced. The overarching aim of smart aged care is to improve city accessibility by taking into account a number of initiatives such as a streamlined approach to upgrade residential care facilities, social inclusion and wellbeing programs, occupational therapy, assistance at home and so forth.

Smart homeless reduction

A smart homeless reduction solution aims to combat homelessness at its root causes rather than trying to remove the homeless. Earlier this year, the city of Adelaide, in collaboration with the state government and community partners, initiated the functional zero homelessness solution. Incorporating technological innovations and data-driven strategies to complement the traditional shelter solution has been rolled out by many municipalities to reduce homelessness in many smart city projects across the world.

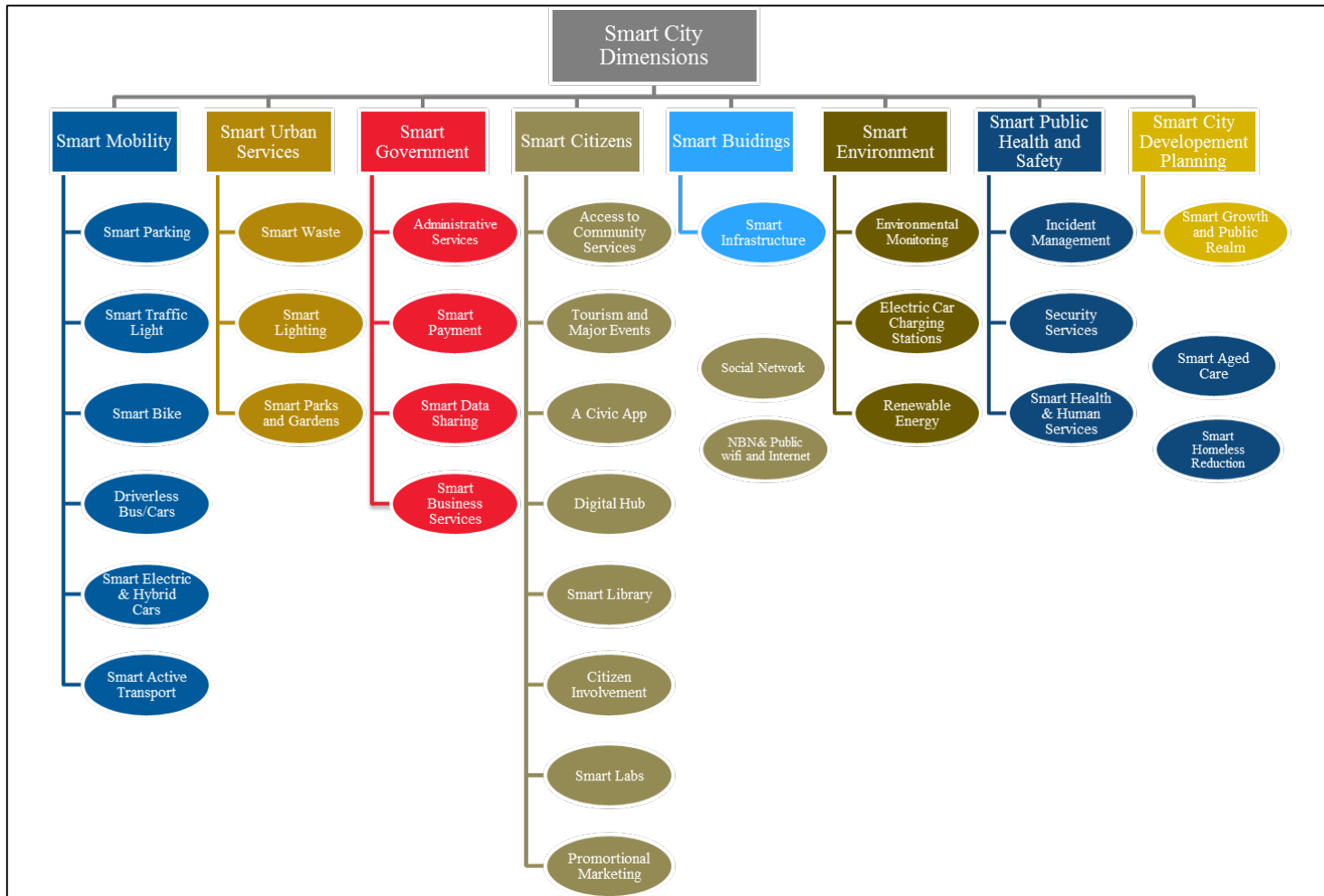
5.8. Smart city development planning

Citizens would benefit from new technologies applied to urban planning processes and systems which increase access to information and regulations.

5.8.1. Smart growth and public realm

Smart growth and public realm refers to taking a long-term approach for developing a high quality public realm which facilitates public life and social interactions. A high quality public realm attracts people and activities which in turn boosts economic growth and improves cultural activities.

Figure 1 – Smart City Framework



6. Proposed Framework

Based on the literature review presented in the previous section, we developed a framework (please see figure 1) which was used to assess the smart city activities from the Metropolitan Local Councils.

7. Scope of the Smart City Snapshot and Methodology

The **aim** of the Metropolitan Local Council smart cities snapshot is to provide information about the level of maturity that the MLGG councils have reached, with regards to smart cities activities.

The snapshot highlights key projects proposed, in pilot phases, or underway, and potential collaboration opportunities for Local Councils, based on the smart city dimensions rather than on individual projects.

The **major objective** of this report is to provide a starting point for Local Councils to develop strategies to improve and benefit from other smart city projects.

7.1. Evaluation method

The Metropolitan Local Government Group (MLGG), a forum of the Local Government Association (LGA), is comprised of 19 Local Councils and we were able to contact 17 of those from the contact details for smart city

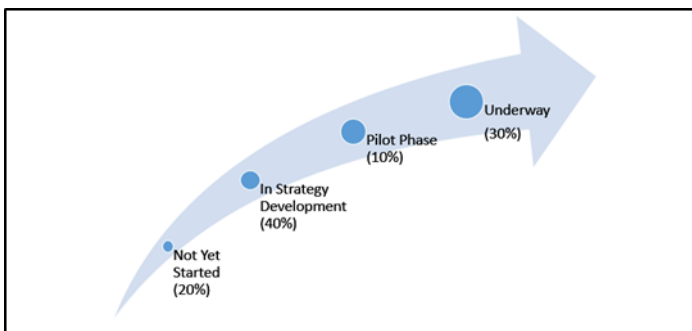
representative leaders provided by the LGA. Information was collected through telephone and e-mail interviews, and on-line surveys. These were used to collect information on the stages that councils have reached in the smart cities process, and the identified dimensions in which they have significant projects, investment and potential collaboration interest. Secondary data was collected by scanning Council websites, other websites and newspaper articles.

8. Insights for the Smart City Local Governments Projects

In this section, we present the information collected via the on-line survey, complemented with some secondary data in some cases (where 87 smart city activities/projects were identified). We received responses from 10 Local Councils (from a potential 17 Councils for which we had contacts) which means that 59% of all Councils responded to the questionnaire.

The diversity of Local Council representatives who responded to the survey indicates that there is no specific area responsible for “smart cities Projects” across any of the respondent Councils. Titles included Director, Strategic Manager, Business Analyst, Manager Business Enterprises and Communications, Systems and Services Information Manager, smart city Lead and Major Projects Leader.

Figure 2 – smart cities Journey



The smart city initiative is a new and ongoing process for the Metropolitan Local Councils. The Councils are all at different stages of the process and no Council reported that they were

fully transformed or had a detailed road map. Twenty percent of the respondents haven't started yet, 50% are in the strategy development or pilot phase, while 30% of the Councils are underway, as can be seen in figure 2.

The number of projects undertaken by the Councils vary between 4 and 61. Some Councils were able to report on projects in great detail while others provided very general information. For the purpose of the snapshot, only information about the smart cities dimensions will be presented, without introducing detailed information about the specific projects or required investment.

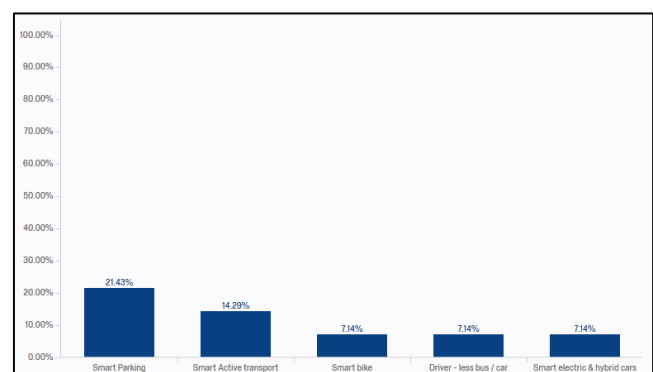
Through the responses, it is clear that there are very different perceptions about the stages of the smart city Journey.

8.1. Key trends and Projects

8.1.1. Smart Mobility

The smart mobility dimension is well underway in many Councils. There are many projects which address smart parking (21%), smart active transport (14%), smart bike paths (7%) and so on (please refer to figure 3). Other projects were identified through the use of secondary data (for two councils which did not complete the survey) in the dimensions of smart parking, driverless busses or cars and smart electric and hybrid cars. However, there is one dimension that has not been introduced by any Councils: **smart traffic lights**.

Figure 3 – Smart Mobility

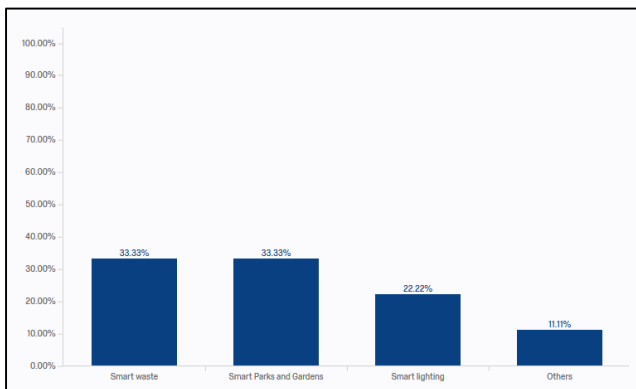


8.1.2. Smart Urban Services

Councils reported that they have undertaken or plan to undertake projects which cover all the sub-dimensions of Smart Urban Services. The most relevant projects in this area are Smart Waste and Smart Parks and Gardens, which represent 33% of all projects, (see figure 4). One of the local councils is working on a project which uses technology from other smart city dimensions and re-adapts it to the parks and gardens area. Via secondary data, we have also identified projects in the Smart Urban Services being undertaken by two Councils that did not participate in the survey.

It must be noted that smart lighting projects had a broad definition, potentially including the replacement of traditional lights with LED-based light sources. While it is understandable why this could be labelled as a smart cities improvement, there needs to be a justifying rationale to count it as a smart cities project.

Figure 4 - Smart Urban Services

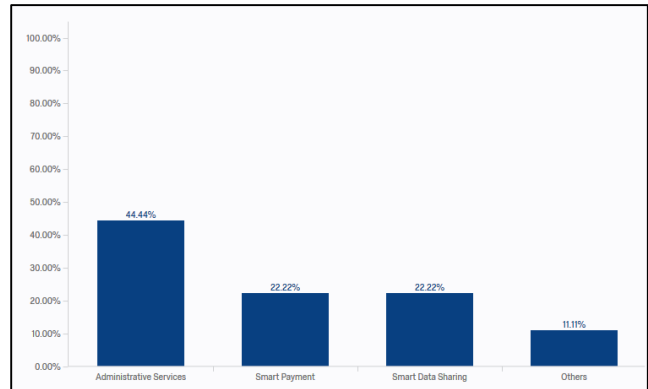


8.1.3. Smart Government

The use of technology for administrative purpose and to facilitate citizen-government interaction is not new and many of the councils have implemented projects in this dimension. From the total number of projects (see figure 5), administrative services represent 44%, followed by smart payments and smart data sharing projects (representing 22% of the projects). In

the Smart Business Services category, three projects were underway and Councils indicated there was potential for much more growth.

Figure 5 - Smart Government

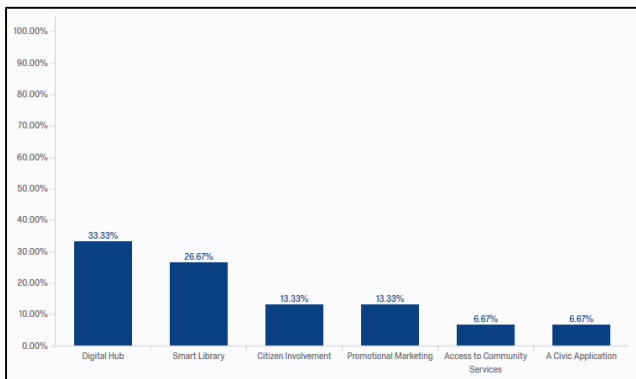


More specifications are required in this dimension for further assessment as digital transformation was mentioned by multiple Councils as a broad concept (classified under "Other 11 %"). This objective should be more thoroughly defined in any follow up audit or survey. No additional projects were identified through secondary data in the sub-dimensions.

8.1.4. Smart Citizens

In the smart citizens' dimension, digital hubs and smart libraries each represent 27% of all projects. Citizens' involvement and promotional marketing both represent 13% of projects, while access to community services and a civic App each represent 7%. The two sub-dimensions that were not directly reported were **Tourism/major events** and **Smart labs**. However, one of the councils is working on a smart project which can be linked to enhancing local tourism. Secondary data from other councils not in-survey identified projects in the sub-dimension of a civic app, and a smart lab project.

Figure 6 - Smart Citizens



8.1.5. Smart Buildings

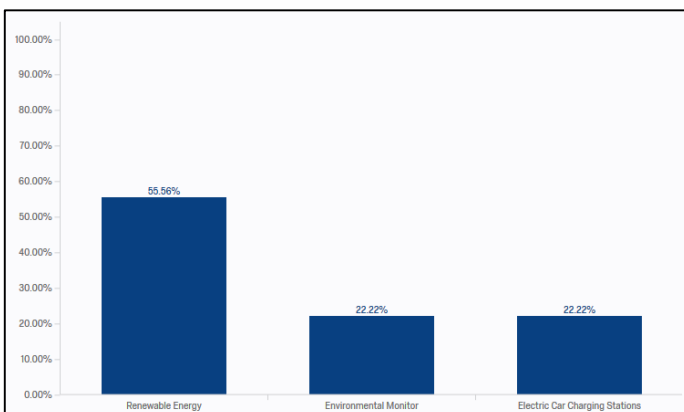
Fifty percent of the respondents reported having projects in the sub-dimension of smart infrastructure (five projects).

8.1.6. Smart Environment

Much has been done in the dimension of smart environment: 55% of projects are in renewable energy, followed by projects in environmental monitoring and electric car charging stations (22% each) (see figure 7).

Additionally, projects in the dimension of environmental monitoring and renewable energy were identified from the secondary data from Councils that did not participate in the survey.

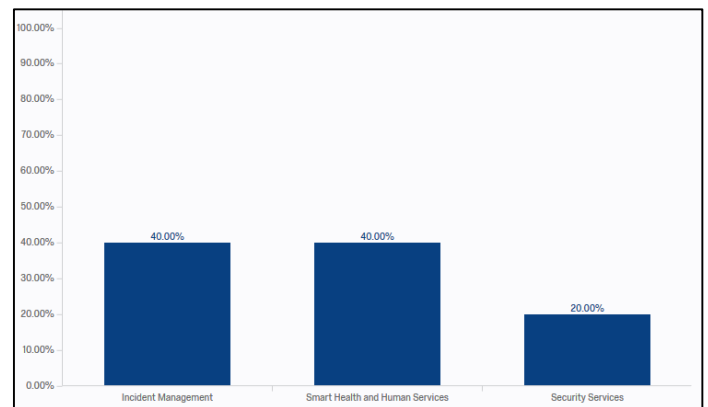
Figure 7 - Smart Environment



8.1.7. Smart Public Health and Safety

Five projects distributed across three working sub-dimensions were reported in the smart environment dimension. Incident management and smart Health and human services each represents 40% of projects, and security services represent 20% (see figure 8).

Figure 8 - Smart Public Health and Safety



In this case, only one additional project was identified from the secondary data from a Council which did not respond to the survey.

8.1.8. smart city Development and Planning

Only two Local Councils reported working on smart city Development and planning. Three projects were identified in the dimension of smart growth and public realm.

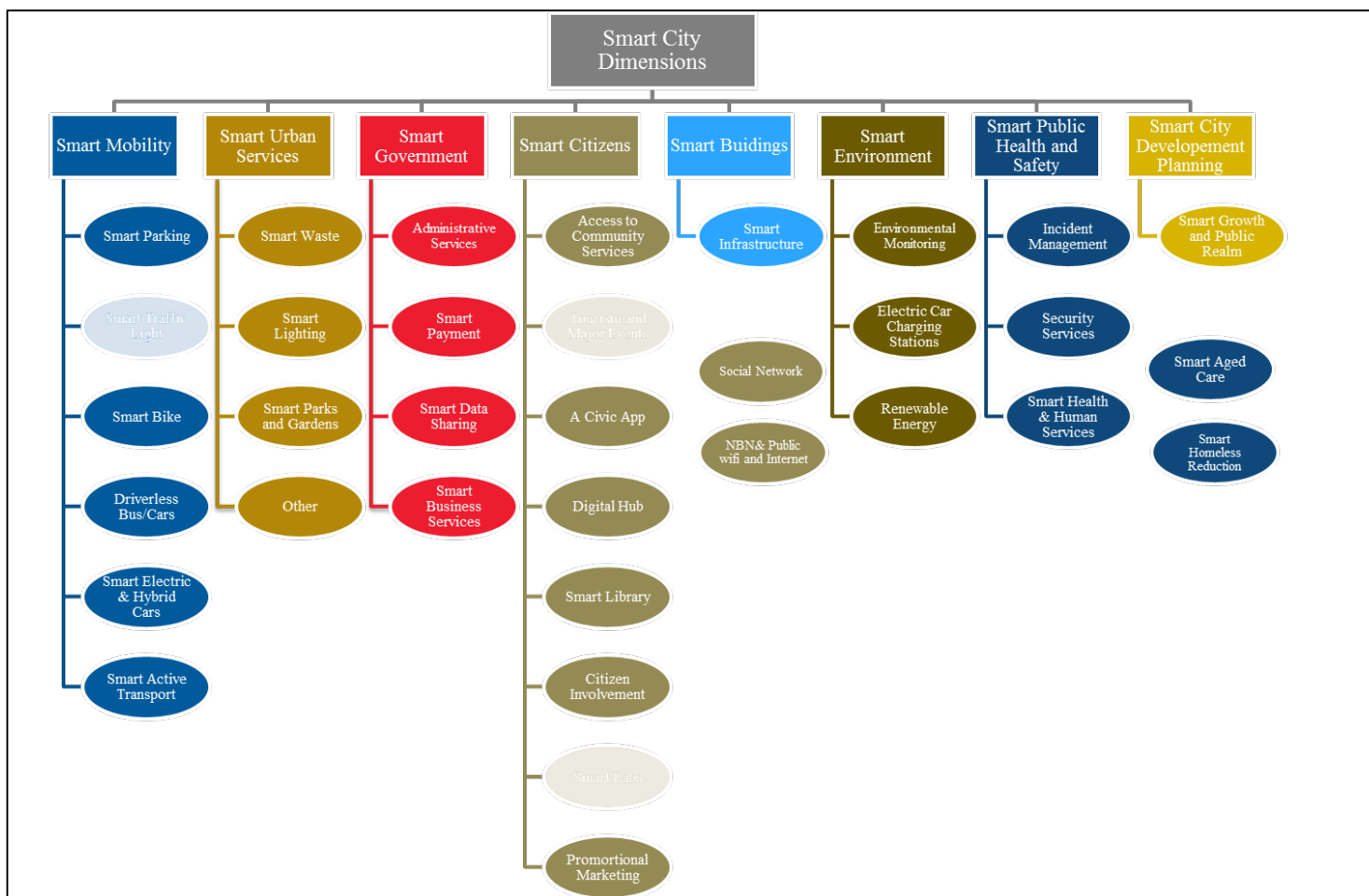
9. Summary of the Smart City Framework

From the collected data, both primary and secondary, it is clear that Local Councils have been working on the majority of the dimensions assessed in the literature review. One additional sub-dimension was added (for Smart Urban Services, 'Other').

There were no projects identified in three sub-dimensions: **Smart Traffic Lights, Tourism and Major Events, and Smart Labs** (these sub-dimensions are lighter in figure 9). In the case of Tourism and major events, one project was identified even though it was not reported, because, although it wasn't directly linked, it could have impact on this sub-dimension. Secondary data revealed a project in the sub-dimension of Smart Labs, however as the Local Council did not response to the survey or

participate in an interview it was not possible to confirm the information. The only sub-dimension without any projects identified via either primary or secondary data analysis was **smart traffic lights**.

Figure 9 – Reviewed Smart City Framework



10. Smart City potential collaborative Projects

interested in collaboration. These potential projects are presented in table 1 below.

The councils responded to the question about their interest in collaborating with other Local Council by identifying smart city dimensions where they would like to collaborate. Five of the eight Smart cities dimensions are relevant for potential projects.

Councils identified only 10 out of the potential 30 sub-groups in which they would be

Table 1 – Potential smart city Projects

| smart city Dimension | smart city Sub-Dimension | Projects Proposal |
|---------------------------------|-------------------------------|---|
| Smart Citizens | Smart Library | Digital Libraries - One Card Network improvements and enhancements |
| Smart Government | Administrative Services | Customer services - Comprehensive and proactive customer service offerings, request handling, tracking and reporting |
| | | Asset Management – Sensor-fitted Waste Vehicles providing data regarding local assets - Administrative services |
| | Smart Business Services | Business Innovation - Tech Start-up - Incubators |
| | Smart Data Sharing | Open Data - Identifying, Capturing, Cleansing, Extracting and Publishing data from Council operations, sensors and archives |
| | | Connected Cities - Parks and Main Streets |
| | | Smart Wayfinding |
| | | Digital Transformation |
| Smart Mobility | Smart Active Transport | Real-time pedestrian, bike and car counters |
| | Smart Electric & Hybrid Cars | Electric Car Charging Stations |
| | Smart Parking | Car Parking |
| Smart Urban Services | Smart Lighting | Smart lighting / lighting controls |
| | Smart Parks and Gardens | Smart Parks |
| smart city Development Planning | Smart Growth and Public Realm | 3D Modelling - Growth and Development |

11. Deeper Discussions (Interview Analysis)

Interviews were undertaken with 70% of the Councils (the questions used are attached as Appendix A). The purpose of this analysis was to further explore smart city themes (presented here in italics).

11.1. *Framing: (Framing Progress, and Framing Smart Cities)*

The majority of responding councils consider themselves to be in the “Strategy Development” phase. Other councils were equally distributed across “Not yet started”, “In pilot phase”, and “Underway”.

It became clear very early, however, that there were very different understandings of what is involved in the smart city Journey. When describing what had and had not already been undertaken, discussed, or engaged, councils that determined themselves as “In Strategic Development” – and even “Not yet started” described some of the same activities and discussions as councils who considered themselves already in “Pilot phase” or “Underway”.

This lack of clarity in terms of what can be considered progress in smart cities Development begins with **lack of clarity of definition**, and therefore lack of clarity around the concepts, strategies, activities, scale and scope of smart cities approaches and initiatives.

This was clearly understood, with all participating councils referring to the need for better understanding and development of this concept. The two major themes dominating this topic were:

- *Awareness, Culture, and Attitude* (including the need for education on these)

- Finding or having an appropriate *Starting Place* for developing as a smart city

And the third dominant theme was:

- The need for a common / agreed-upon *Definition*
- Several respondents mentioned the challenge of finding a *starting place* but this seemed to relate specifically to the need to find an operational starting place, or to prioritise the multiple possibilities and needs, since most were adamant that the core place to start is strategy development.

11.2. *Awareness, culture and a positive attitude*

Most councils also stated the need to develop *awareness, culture, and a positive attitude* to smart city development (mostly referring to within their own council, not to the broader community), and different councils are in various stages along that development journey.

11.2.1. Leadership and sponsorship

A critical aspect of developing *awareness and culture* and of progressing the smart city journey would seem to be the *sponsorship* of executive *leadership* and senior management. Each of the councils who have progressed significantly refer to support and sponsorship by their leadership, or of having “brought management in”. Several specifically gave the credit for their progress to the active sponsorship of visionary and active leadership.

11.2.2. Definition

This theme is discussed elsewhere in this report, but it is important to recognise that it is an impeding factor, particularly in terms of the ability to collaborate.

11.3. Drivers and Critical Elements

There was also considerable overlap in language in describing “Key Drivers”, “Critical Elements”, “Strategic Objectives”, and “Vision”.

The two dominant themes emerging in response to these questions were:

- Concept and Broader Understanding
- Money and Resources

These themes were closely followed by

- Strategy Development
- Citizen-Centric and Community Development
- Strategy and Decision-Making

Concept and Broader Understanding are discussed above.

Money and Resources were almost as significant in terms of focus, and mostly raised in response to the question “What do you believe has been the greatest impediment to becoming a smart city?” The three strongest areas specifically nominated as critical resources were:

- *Agility*, and keeping up with technological advances and opportunities
- *People as resources*
- *Budget constraints*

There were some positive aspects to the theme *Money and Resources*, in that some councils have been awarded, or are aiming to acquire, Federal funding. For the most part, however, lack of finances and other resources are seen as the

greatest impediment to progress and to collaboration.

11.4. Collaboration

Another positive that arose from the resourcing issue was the recognition that limited resources could best be dealt with by pooling them. Collaboration is seen by most councils as critical to their ability to develop effectively as smart cities.

Nor was this attitude solely – or even principally – about dealing with limited resources. It was strongly recognised that collaboration is critical for effectiveness as well as *Efficiencies* (another key theme that arose through several of the questions). *Open data* was mentioned as a key resource that has potential to be an enabler for collaborative leveraging to address resourcing issues.

The ability to work with the *University* was seen as one valuable and critical collaboration. And several *councils are already meeting and working together* in different combinations – sometimes to leverage proximity, and other times because of important similarities in council profile and demographics.

However, *one key collaboration necessity* was seen as the critical need of the *citizen-centric* view. That the experience of a citizen / members of the community should be seamless as they cross council boundaries. Examples given included driving from city to beach or city to hills, and the very different road and lighting experiences that a citizen passes through in what – from the citizen point of view – is “one trip through one city”. Another example was the difference of next door neighbours in different council areas paying radically different fees for significantly

different experiences in, for instance, waste disposal.

It was recognised, however, that although the need to be able to collaborate to provide a *seamless experience to citizens and tourists*¹ is a high priority, it is also a significant challenge, as each council area has its own priorities, strategies and budget.

11.5. *Citizen-centric and Community-building*

A common theme was that councils have developed far beyond the traditional areas of “roads, rates, and rubbish” and are now responsible for developing community, culture and environment, as well as providing amenities and services that are now seen as fundamental to daily living as roads and rubbish used to be. These amenity- and service-based themes are discussed more extensively below, but it is notable that most of the councils gave community-building and culture a very high priority as drivers for smart city development.

11.6. *Embedded and Integrated: Smart is Normal*

A predominant attitude was that it is necessary to ensure that smart city Initiatives not be an “add-on” or supplement to the normal business of council, and equally that it not be a matter of grabbing technology and using it just because it’s available. The majority of respondents were emphatic that smart city approaches should be *integrated and embedded* into delivery of the *strategic plans and vision of council*. Several also mentioned that they had begun to recognise that they were already implementing what could be considered to be smart city approaches or initiatives, but hadn’t recognised them as

such, simply because they were just leveraging available technology to address their ordinary needs; in other words, “*smart is normal*”.

11.7. *Strategic Development, Strategy and Decision-Making*

There were distinct differences in the communications made about the role, process, and current status of *Strategic Development* and the identifiable theme of *Strategy and Decision-Making*. The concepts of *Embedding and Integrating*, and *Smart is Normal* were key items in Strategy Development, as were references to *Consultations* with various stakeholders, Workshops for strategy development, use of Working Groups, and the need for *embedding Fundamental Principles* as a bedrock foundation for direction before moving into operations. Another theme that arose in discussions about being in the Strategy Development Phase of becoming a smart city, was the criticality of *IT and Technology Competence* (or lack of it), working with *Legacy Systems*, and being able to *Leverage* specific technologies as early as possible, and quick “wins”. Examples included *NBN, Public Wi-Fi, libraries, QR Codes, CCTV, and Smart Parking*.

The theme of *Strategy and Decision-Making*, however, was focused much more on leveraging smart city approaches to accomplish “*The Business of Council*”, including *better decision-making and solutions, delivering strategic outcomes, efficiencies*, and being able to use *metrics* to ensure outcomes are *measurable*. *Data and data management* were themes that arose as critical to a number of different issues, but particularly to the ability of council to develop strategy and make better, more informed

¹ Several councils stated that tourism and tourists are a vital demographic for their considerations

decisions. *Technology* and the *human* resources to leverage data and data management better are seen as fundamental.

11.8. Operations

Several councils emphasised that it was these less tangible outcomes, listed under the theme of Strategy and Decision-making that were considerably more important than the more highly visible operational outcomes such as Smart Parking. There was, however, recognition that it is also important to be agile and keep up with technology to the degree expected by stakeholders, including citizens, business, and industry. One of the most obvious noted was the “*there’s an app for that*” mentality – that most citizens can manage their finances on their mobile phones, and expect to be able to manage their local council needs just as easily.

The one dominant theme in terms of operationalising smart city approaches – particularly in terms of early developments – is that of *connectivity*. This refers to connectivity in terms of *roads and parks*, but also in terms of *connectivity between citizens and council*, council amenities and council services. Equally emphasised is connectivity in terms of *community-building*.

11.9. Future-Proofing

A concept that arose frequently was *Future-proofing*. Some of the core ideas that seem to be encompassed within this concept were sustainability and environment, health and safety, providing adequate services and amenities to rapidly expanding population, providing for the aging demographic, and

digital literacy. *Low-risk living* was a particularly critical aspect mentioned, particularly considering cyber security and safety, but also encompassing physical safety.

Multiple themes existed under concepts such as “*More liveable*”, many of these also coinciding with *future-proofing* themes. *Low-risk living*, *urban greening*, *reduction of homelessness*, *smart waste management* and *road management*, *public transport*, and *urban design*. These topics, however, were mostly mentioned in passing, as the focused core for all the councils was very much more on building *principles* and *strategies* as foundations upon which such operational matters can be developed.


11.10. Research and Benchmarking

Most of the councils have invested, to some degree, in research and/or benchmarking, with varied approaches. These included outsourcing to professionals such as Gartner, extensive Internet-based research looking at other smart city operations nationally and internationally, using personal links to gain insider insights into organisations like San Francisco’s Motor Transport Authority, and the most common of all – collaboration with local universities, particularly the University of Adelaide.

11.11. Other external resources

Other collaborations and outreach externally were considered to be more useful for addressing specific problems rather than undertaking base research, include tapping into the Code for Australia program, and also approaching and working with the local hacker community.

Key Points

- Common grounds for data collection and measurement (homogenisation of data). Sharing information – lessons learned/dashboard
 - Creation of working groups (industry, academia and government) to facilitate smart city projects / Increase innovation process through idea cross-fertilisation
 - Identify South Australian strengths in order to become a leader in smart city projects around the world. Creation of a South Australian Smart City Strategy.
 - Share resources to increase smart city project performance (economies of scale and scope)
- 

12. Policy considerations for growing the Smart City Projects

smart city Projects have been increasing in importance all over the world as population density in cities grows. Technology can be used to improve liveability, sustainability, security, communication and development. Local Councils in Adelaide may play a very relevant role in the development of smart city strategies and projects which can benefit the local population in many different ways. The purpose of the snapshot was to identify the current situation and to propose ways for moving forward.

The snapshot shows diversity in the depth and breadth of Councils projects as well as diversity in the interpretations/perceptions of what it means to be a smart city.

Despite different approaches to smart city development between various councils, the similarities are much stronger than the differences. All the councils are committed to citizen empowerment, community-building,

and improved liveability; most are committed to ensuring that smart city development is integrated into strategic development and not treated as a technology grab-bag or add-on. The need for greater awareness and the development of smart city initiatives is also a unifying theme throughout.

From the data collected through the survey process we identify that comparing Councils is a complex issue, showing the difficulty of measuring or assessing them because of the lack of unified concepts and definitions. This was also pointed out as an impediment for collaboration.

This suggests that common ground for reporting processes would allow better comparison between Councils and increase awareness of smart city dimensions which requires more attention. A possible Collaborative smart city project was identified in the snapshot – a local Council proposed sharing smart city Projects information to benefit all the metropolitan Council areas. We recommend not only sharing the information but also creating a system to capture relevant and comparable data which allows for comparability between the councils.

We also suggest an additional project in this area – a Smart City Dashboard database, using data homogenisation and creation of clear measurements and standards. The data and information availability would not only allow Councils to be on the same page but also allow citizens access to news on projects and information on projects, creating awareness and a positive attitude towards Smart city projects. A further step could include performance indicators from each Council to inform citizens on how they're benefiting from technological applications.

Once agreement on measurements, concepts and data homogenisation is reached, we also recommend the creation of an industry/academia advisory group. The industry/academia advisory group should involve relevant representatives from areas such as energy, water, health, education and technology (10 to 12 members is recommended). This will help create a collaborative environment between industry, government and academia for idea cross-fertilisation, allowing innovation enhancement which is imperative for the development of the South Australian smart city Strategy.

Establishing ways of sharing information between councils could stimulate new synergies and increase Adelaide's ability to compete at an international level and be recognised as an outstanding example of a smart city.

The advisory group could also help them to achieve economies of scale or economies of scope to save cost in the collaborative smart city Projects portfolios. Economies of scale could help Councils to save money. The cross-fertilisation of ideas could also create economies of scope by using existing technology in other smart city project areas.

Another starting point is to work on projects identified by Council representatives for collaboration purpose. They have identified ten sub-categories including 14 projects where they would like to find partners with which to collaborate. The proposed projects have been presented in this report and they are ready for the next step.

With regard to the project portfolios, some Councils are working very well and have a great portfolio of projects. The smart cities Dashboard (including performance measurements) would identify clear roles in the smart cities areas, such as leaders or followers.

Leaders could leverage the work that they are doing in their councils and share their experiences with the rest of the councils. It is also relevant to create a "lessons learned" information dataset which can be used as an instrument to improve the performance of smart city projects over time.

This study identifies four key points for further work and proposes potential pathways to improve Adelaide's impact and visibility in the world smart city landscape.

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Appendix A: interview questions

The on-line questionnaire asks where you think you are on your smart city Journey: Not yet started, In strategy development, Detailed roadmap, Pilot phase, Underway, Fully transformed.

1. Why did you give the answer that you did?
2. What do you believe are the key drivers for adopting smart cities approaches?
3. If you are not yet fully transformed, what is required to take you to the next stage? If you are fully transformed, what is required to hold you at that level?
4. Which national or international benchmarks (if any) have you used on your journey towards full transformation?
5. Do you have a mentoring organisation or exemplar in the Australian or International local government community that you have sought to model or consult with regularly?
6. What do you believe has been the greatest positive factor in achieving your goals in this area?
7. What do you believe has been the greatest impediment?
8. Is there anything else that you'd like to discuss or mention?



SMART CITY PLAN 2018 - 2025

CHARLES STURT — A LEADING, LIVEABLE CITY

CITY OF CHARLES STURT - SMART CITY STRATEGY OVERVIEW

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WHY WE NEED A SMART CITY

Smart Cities attract knowledge, creativity and investment helping to grow the economy.
In an increasingly digital and technology driven age, cities need to look towards new approaches, innovative technologies and smart infrastructure to create an environment that supports both community and economic growth.

OUR SMART CITY VISION

Charles Sturt is a leading smart city that uses information and technology to better respond to its community and business needs
By 2025 we will be...

- A city that has a strong and connected community by using emerging smart technologies and enables everyone to participate
- A livable city that uses smart technology in its public places, connects people, and uses technology-enabled infrastructure
- A city that applies technology and innovation to overcome future environmental challenges
- An economically thriving city that has access to digital infrastructure and leverages it to support business growth, investment and sustainability across priority sectors
- Provide transformational leadership that fosters collaboration across government, industry and business

OUR APPROACH - GUIDING PRINCIPLES

Guiding Principles

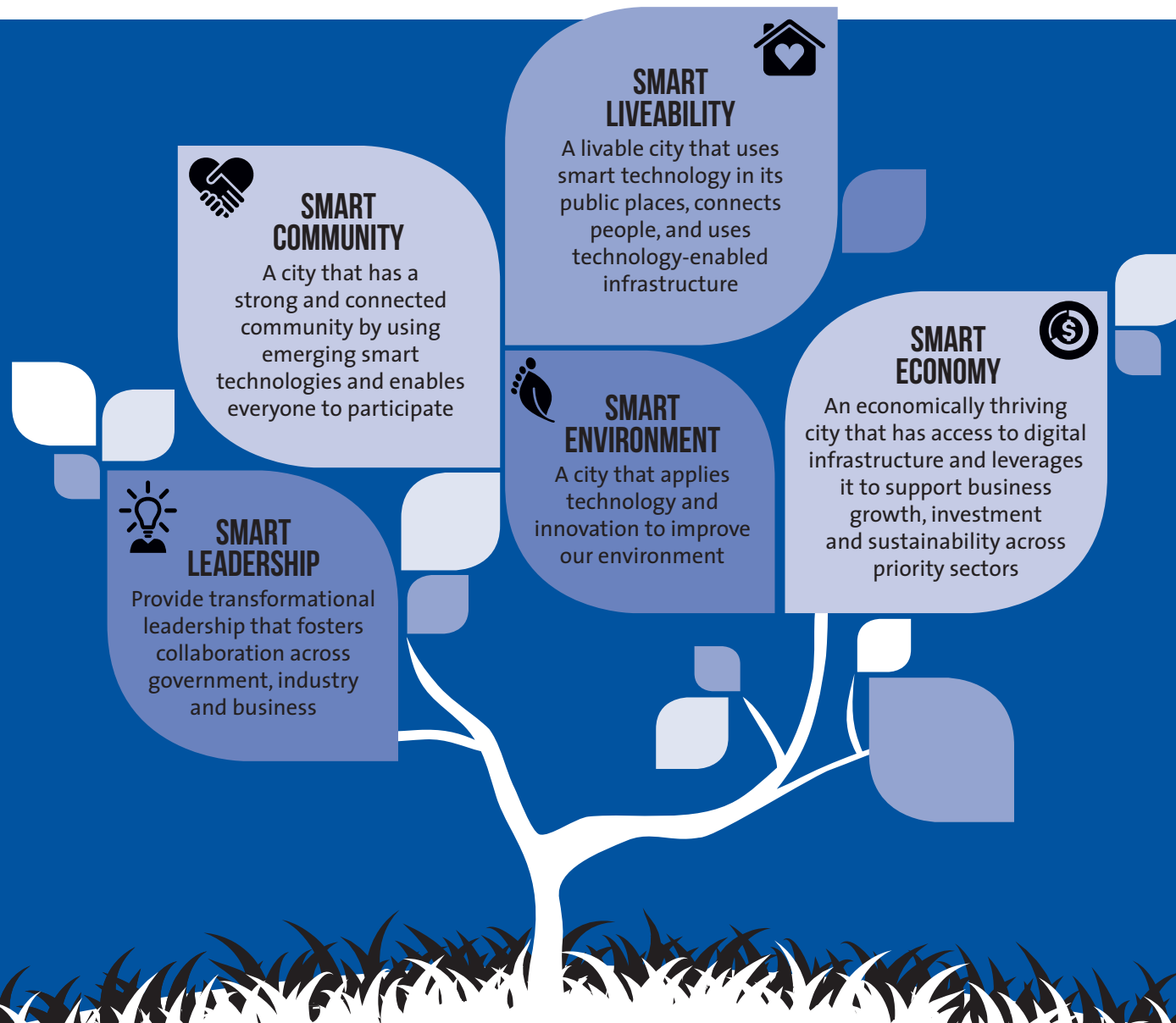
To be flexible and recognise that new opportunities will continually arise as digital technologies evolve. Potential new activities can be assessed and prioritised based on alignment with the strategic outcomes and initiatives that underpin this Strategy.

| | |
|-----------------|--|
| Citizen Centric | Residents, business, entrepreneurs, industry and government will be engaged early and often. We will use technology to be more community connected and encourage participation, access and inclusion through the design of citizen centric digital services. |
| Collaboration | We will make it easy to partner and focus on shared outcomes. |
| Innovation | We will influence regulation to reduce red tape, test and trial new technology. |
| Sustainable | We will develop digital city standards and leverage new business models. We will be commercially driven and ensure the Business Case 'stacks up'. |
| Measurable | We will measure the effectiveness of the smart city approach to projects |

BENEFITS

- customer experience
- education and advice that is easy to find, understand and act on
- Value from city assets
- Improved efficiency of services
- Business and innovation and investment
- Improved community engagement by involving people in the design of government services.
- Increased benefit to the economy through the release and use of open data
- Charles Sturt is recognised as a modern and progressive place to live and work
- Real-time alerts and monitoring to create city wide situational awareness
- Reduced carbon emissions and energy

SMART CITY OVERVIEW - GOALS



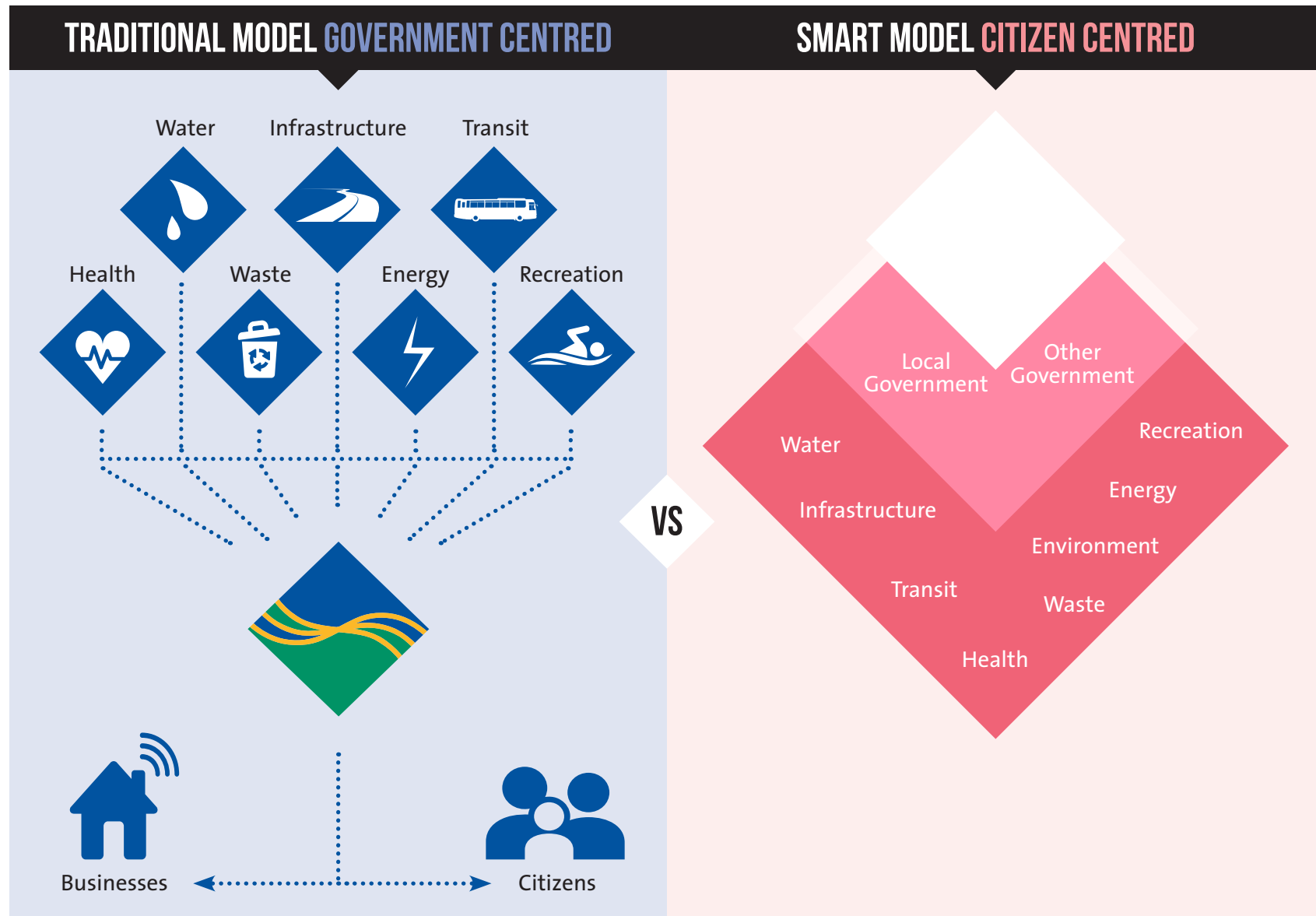
Our Smart City Plan is designed to be read in conjunction with the “Community Plan 2016-2027; Charles Sturt – A Leading, Liveable City”.

We want our Smart City initiatives to be led by community and business needs, as a result we have used the themes from the Community Plan as the basis of our Smart City Plan.

WHAT IS A SMART CITY?

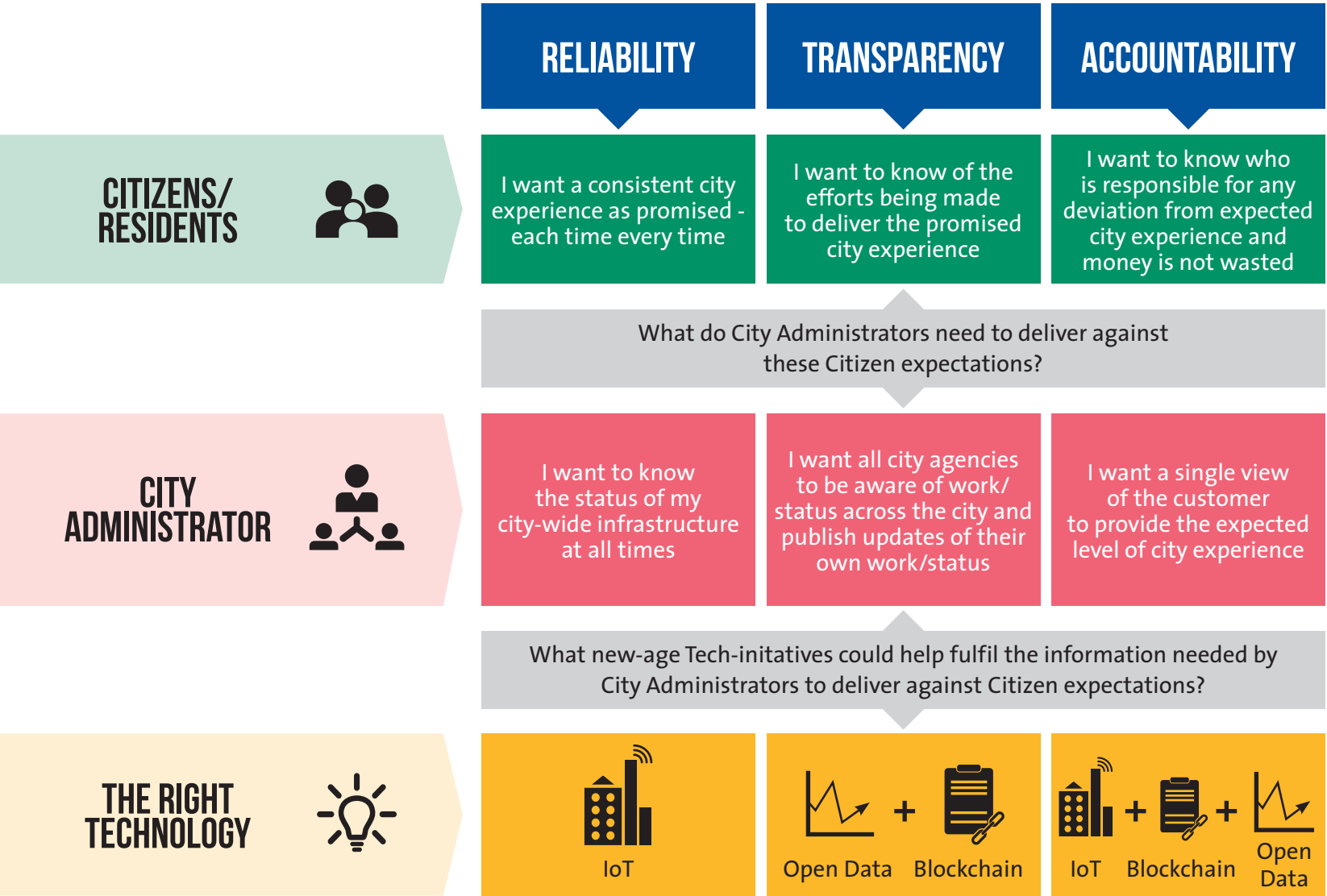
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A Smart City combines the physical and digital worlds to deliver a sustainable, prosperous and inclusive future for its citizens. It is not about technology for technology sake, but about how technology is used to help the city function effectively. It builds on the existing foundation within the city and enables it to set a more engaging vision and follow a new and more effective path into the future.



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EXPECTATIONS FROM A SMART CITY SERVICE



Adapted from Anveshi Gutta, PwC

WHY IS A SMART CITY IMPORTANT?

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As the City of Charles Sturt moves forward, it must use its resources as efficiently as possible, manage environmental impacts, infrastructure maintenance, an increasing population and an expectation of citizens for 'Google-like' services. People expect better service, while minimising costs and to respond to them through multiple channels.

Innovation, digitisation and the Internet of Things (IoT) will help Council and the Community build a more connected and resilient City. In an increasingly digital and technology driven age, cities need to look towards new approaches, innovative technologies and smart infrastructure to create an environment that supports both community and economic growth.

The Smart City Strategy offers us a way to think differently about how services can be delivered. It guides the creation of a Smart Community by identifying the elements necessary to achieve a successful and integrated program of smart and connected systems.

WHY NOW?

| INCREASINGLY NECESSARY | URBAN DENSITY | AGING POPULATION | ENERGY REQUIREMENTS |
|---------------------------|--|---|---------------------------------|
| TECHNICALLY POSSIBLE | AFFORDABLE SENSORS BETTER BATTERIES | BETTER NETWORKS BETTER MESSAGING | BIG DATA REAL TIME |

BENEFITS

- Customer experience
- Information and advice that is easy to find, understand and act on
- Value from city assets
- Improved efficiency of services
- Business and innovation and investment
- Improved community engagement by involving people in the design of government services.
- Increased benefit to the economy through the release of open data
- Increased perception of Charles Sturt as a modern and progressive place to live and do business
- Real-time alerts and monitoring to create city wide situational awareness
- Reduced carbon emissions and energy

The Smart City Strategy sits across Council's other plans and is intended to be implemented by Council business units with support from a multidisciplinary Smart City Project Team.

Council does not hold all the answers, this Strategy represents a call to action to business, government, thinkers, entrepreneurs and the community to work together to build the Smart City. It is designed to be flexible, in recognition that new opportunities continually arise as digital technologies evolve. Potential new activities can be assessed and prioritised based on alignment with the strategic outcomes and initiatives that underpin this Strategy.

We will be actively open, looking to partner with anyone that has the idea, capacity or resources to co-create impactful solutions to address our challenges. On the Council's part, we will put in place the infrastructure, policies, and enablers to encourage innovation. We will strive to create the space and mindset for experimentation and risk taking.

In order to fulfil our vision for a Smart City, a roadmap of specific projects and initiatives is needed, including both early "quick wins" and longer term strategic programmes. We will concentrate initial effort on those that are simplest to execute because they are within the remit of our single organisation or because they build on cross-organisational initiatives with surrounding Councils that are already underway. We believe this will form a powerful program for making City of Charles Sturt Smarter.

GUIDING PRINCIPLES

To be flexible and recognise that new opportunities will continually arise as digital technologies evolve. Potential new activities can be assessed and prioritised based on alignment with the strategic outcomes and initiatives that underpin this Strategy.

| | |
|------------------|---|
| Customer Centric | Residents, business, industry and government will be engaged early and often. We will use technology to be more community connected and encourage participation, access and inclusion through the design of citizen centric digital services. |
| Collaboration | We will make it easy to partner and focus on shared outcomes. |
| Innovation | We will influence regulation to reduce red tape, test and trial new technology. |
| Sustainable | We will develop digital city standards and leverage new business models. We will be commercially driven and ensure the Business Case 'stacks up'. |
| Measurable | We will measure the effectiveness of the smart city approach to projects |

Project Prioritisation: priority will be given to projects that meet any of the following criteria.

| | |
|--------------------------|---|
| 1. In Train | We already have a project underway that supports one or more of our Smart City Objectives |
| 2. Foundation Project | Particular infrastructure that is required to support Smart City Objectives |
| 3. Strong Business Case | A commercial business case that shows significant savings or community benefit |
| 4. Funding Available | Grant Funding is available |
| 5. Demonstration Project | Pilots and demonstrations projects that are visible to the community and displays the community benefit |

PLANNING CONTEXT

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CITY OF CHARLES STURT STRATEGIC PLANS & FRAMEWORKS - ALIGNMENT TO COMMUNITY PLAN THEMES

OUR COMMUNITY

Community Services Framework
Regional Public Health Plan 2014-2019
Animal Management Plan 2016-2020
Marketing and Communications Plan

OUR LIVEABILITY

Charles Sturt Development Plan
Strategic Directions Report 2014
Community Land Management Plans
Place Making Framework
Asset Management Plans
Transport Plan 2016-2031
Open Space Strategy 2025

OUR ENVIRONMENT

Living Green Environmental Plan
AdaptWest

OUR ECONOMY

Economic Development Plan 2016-2021
Building Western Adelaide

OUR LEADERSHIP

Long Term Financial Plan
Annual Business Plan & Budget
Council Policy Framework
Cultural Change Program
City Survey

CITY OF CHARLES STURT SMART CITY STRATEGY - ALIGNMENT TO COMMUNITY PLAN THEMES

FEDERAL GOVERNMENT - NATIONAL INNOVATION AND SCIENCE AGENDA - SMART CITIES PLAN



Goal - A city that has a strong and connected community by using emerging smart technologies and enables everyone to participate

Alignment to Community Plan

Provide accessible social infrastructure and services that engage our diverse community.

Capitalise on partnerships, build community resilience and sense of belonging.

Create opportunities for community leadership and civic participation.

Educate and regulate to enable a safe and healthy environment.

| Smart Objective | Actions | Years | | | Responsibility |
|--|--|---------------------|---------------------|-----|--|
| | | 1-2 | 3-5 | 6-7 | |
| Engage with customers by sourcing, implementing and developing technology. | <ul style="list-style-type: none"> Implement a customer centric Civic Participation Platform that allows two-way communications with the Council. Research and explore virtual conversational interfaces for Customer Support eg AI based ChatBot Work with the LGA and LGITSA to update the My Local Services App for improved access to Council services and information on the city Implement Council meeting video and transcripts to effectively communicate Council decisions. Investigate a customer centric city dashboard for visualisation of key city data relevant for citizens and visitors | * | * | | Marketing/Information Services Customer Contact Marketing/Information Services Governance Information Services/Barbara James |
| Improve digital literacy and ensure equitable community access to technology and its benefits. | <ul style="list-style-type: none"> Continue to support and engage the local Maker and Community groups/clubs to provide a range of technology programmes that build digital skills and confidence. Create a “lendable technology” range through the library that provides affordable access to maker electronics, virtual reality and other emerging technologies Adopt educational programs to increase community levels of digital literacy around cyber security, e-commerce and privacy. Maximise the benefits of the West Lakes Library and Community Centre redevelopment to ensure it is a lab for collaboration and innovation | * * * | * * | | Community Connections |
| Support inclusion and accessibility through digital technology | <ul style="list-style-type: none"> Investigate smart assistive technology to improve equity of access to the city Research technology that enables socially isolated citizens to participate in their community Pilot alternative customer service channels to assist with language, hearing and other communication challenges. Investigate the viability of providing 24x7 library access | * | * * * | | Community Connections |



Goal - A livable city that uses smart technology in its public places, connects people, and uses technology-enabled infrastructure

Alignment to Community Plan

An urban environment that is adaptive to a changing and growing City.

City assets and infrastructure are developed and well maintained on a strategic and equitable basis.

Create valued urban places that bring people together and reflect local character and identity.

Drive an integrated, responsive transport system and network.

Enhance the quality and diversity of open and public spaces.

| Smart Objective | Actions | Years | | | Responsibility |
|--|---|-------|-----|-----|--------------------------|
| | | 1-2 | 3-5 | 6-7 | |
| Enhance efficiencies and the liveability of our city by Implementing technology enabled infrastructure | <ul style="list-style-type: none"> Implement strategic on-street parking sensors to track, monitor and manage parking decisions Research and identify technology to collect real-time data to assist with asset planning and management - including parks, buildings, local streets and neighbourhoods Work with developers to identify opportunities for smart infrastructure in new developments eg public wifi, charging stations, way-finding Continue to promote and support bike and car share networks Deploy free Public Wifi at strategic Council precincts and public spaces | * | * | | Engineering |
| | | * | | | Engineering/Open Space |
| | | * | * | * | Engineering and Planning |
| | | * | * | * | Engineering |
| | | * | * | | Information Services |
| Promote projects, experiences, events and local history with interactive technologies | <ul style="list-style-type: none"> Continue to use and expand on time lapse video, Virtual Reality and Drones for project engagement Develop a business case for creating a City Tour application with Augmented Reality to highlight and complement art, culture and heritage around the city. Use smart technologies to better understand and respond to specific conservation needs of key heritage (built, cultural, environmental) sites Take advantage of smart infrastructure to enhance precincts and cultural assets by incorporating lighting and sound experiences in key pedestrian zones | * | | | Engineering/Marketing |
| | | | * | | Place making |
| | | | * | | Urban Projects |
| | | * | | | Urban Projects |
| Support sustainable transport modes by collecting and leveraging data | <ul style="list-style-type: none"> Implement real-time pedestrian and cycling counters on strategic corridors/zones. Research sensor technology to gain network-wide real-time performance indicators such as, travel times, average vehicle speeds and origin-destination Partner with Government and Industry to better understand and present available transport data eg DPTI, Fitbit, Strava | * | | | Engineering |
| | | * | | | Engineering |
| | | * | | | Engineering |



Goal - A city that applies technology and innovation to improve our environment

Alignment to Community Plan

Continue to implement climate change mitigation and adaptation solutions.

Enhance the state of the City's environment and biodiversity.

Lead and educate to reduce the City's impact on the Environment and build resilience.

| Smart Objective | Actions | Years | | | Responsibility |
|--|---|---------------------------|-----------------|-----|---|
| | | 1-2 | 3-5 | 6-7 | |
| Support environmental decision making by collecting and leveraging data | <ul style="list-style-type: none"> Use technology to actively monitor the impacts of climate change including urban heat and tree canopy Expand access to roof top solar on Council buildings taking advantage of Virtual Net Metering opportunities Create a citizen science program to raise education and appreciation of our environment | * * | * * | | Open Space and Property Waste and Sustainability Open Space and Property |
| Incorporate smart environmental technology and design into projects | <ul style="list-style-type: none"> Use urban design techniques that respond to the changing climate and community needs. Work with utilities/partners to improve smart power and water technology with real-time data analytics to improve the efficiency in Council buildings and on public open space. Work with SAPN to deploy LED smart lighting across the city Deploy smart bin infrastructure in strategic locations Advocate for all new development to contain smart environmental technology | * * * * * | * | | Open Space and Property/Engineering Waste and Sustainability Waste and Sustainability |
| Use emerging technologies to engage citizens in sustainable environmental behaviours | <ul style="list-style-type: none"> Utilise RFID and sensors for domestic garbage pick-up to collect waste data and incentivise recycling Explore the benefits of an environmental reward points scheme Develop a program inclusive of sporting clubs to raise education and appreciation of the benefits of smart technology | | * * * | | Waste and Sustainability |



Goal - An economically thriving city that has access to digital infrastructure and leverages it to support business growth, investment and sustainability across priority sectors

Alignment to Community Plan

Lead regional collaboration to promote the western Adelaide economy.

Support and enable local business prosperity and growth.

Facilitate an environment for a diversity of business and industry types.

| Smart Objective | Actions | Years | | | Responsibility |
|--|---|---------------------|-----|-----|---|
| | | 1-2 | 3-5 | 6-7 | |
| Identify and understand what our businesses need from digital infrastructure (roadmap) | <ul style="list-style-type: none"> Consult targeted sectors eg Health, Creative Industries, precincts eg Woodville Road & Hendon and enterprises via survey, interview, workshops etc to identify priority needs and opportunities for infrastructure, innovation and capability development Summarise findings from consultation to determine priorities and develop a plan for infrastructure, innovation & capability development. Seek funding for above from Council, government and other sources. | * | | | Economic Development |
| Promote new ways of doing business | <ul style="list-style-type: none"> Support business collaboration and innovation through such vehicles as co-working places, business hubs, hackathons, on-line tools, learning, access to data & resources. Promote links with business, universities and government to drive innovation, economic growth and open learning Encourage businesses to utilise technologies to innovate find new ways of doing business, find and service markets and collaborate eg AI, automation, ERP, marketing, accounting, CRM, 3D printing, crowd sourcing. Promote & facilitate access to high speed broadband to enable business and the community eg SABRENET and GigCity in targeted locations | * * * | * | | Economic Development Economic Development / Information Services |
| Businesses to be able to undertake more efficient interactions with Council | <ul style="list-style-type: none"> Provide a platform for business to easily access Council and other Economic information and data to encourage innovation and investment Identify and implement tools and strategies to aid engagement communication, promote Council's services, attract investment and engage businesses eg revised / new website, Customer Relationship Management system to improve engagement and communication with business groups. | * * | | | Economic Development |



Goal - Provide transformational leadership that fosters collaboration across government, industry and business

Alignment to Community Plan

Be bold and innovative in our practices, leadership and decision making.

Adaptive and sustainable management of the City's finances.

A collaborative, agile and high performing work place.

Practise transparent and accountable governance.

| Smart Objective | Actions Please use the ideas below as a starting point | Years | | | Responsibility |
|--|---|-------|-----|-----|---|
| | | 1-2 | 3-5 | 6-7 | |
| Implement Smart City ICT Infrastructure | <ul style="list-style-type: none"> Advocate for and deploy multiple Low Power networks such as Sigfox and Lorawan Implement an Enterprise Internet of Things (IoT) platform Implement an Enterprise Data Platform that includes integrated data analytics Implement an Enterprise Beacon network platform Adopt open standards to ensure interoperability between systems Connect Council to the SA Government SABRENet WAN | * | * | | Information Services |
| Digitally transform Council operations and service delivery | <ul style="list-style-type: none"> Design and build a dynamic Smart City website to promote and solicit ideas and challenges from the community Transform existing services to be citizen centric digital services Staff education with digital literacy and awareness | * | * | * | Marketing/ Information Services Information Services Information Services |
| Develop a strategic approach to open data, enhancing transparency and enabling data driven decision making | <ul style="list-style-type: none"> Create an open-by-default policy for all Council data. Implement an Enterprise Open Data Portal to allow public access to council data sets | * | | | Information Services |

Appendix 2: City of Marion Smart City Projects

| Theme | Towards 2040 Vision | 10 Year Goal | Current Smart City aligned Projects | Short Term Projects proposed |
|----------------|--|--|---|--|
| Liveable | By 2040 our city will be well planned, safe and welcoming, with high quality and environmentally sensitive housing, and where cultural diversity, arts, heritage and healthy lifestyles are celebrated | By 2027 will be have attractive neighbourhoods with diverse urban development, vibrant community hubs, excellent sporting facilities, open spaces and playgrounds | Living Laboratory for Ageing Well Smart assistive technology to improve equity of access to the city | Monitoring of playgrounds using sensor technology to better understand use |
| Valuing Nature | By 2040 our city will be deeply connected with nature to enhance peoples' lives, while minimising the impact on the climate and protecting the natural environment | By 2027 we will improve stormwater management, increase energy efficiency, promote biodiversity and improve opportunities for people to play in open spaces and interact with nature | Oaklands Water Business Thermal mapping Aerometrix assessment of coastline Contribution to solar garage at Tonsley | |
| Engaged | By 2040 our city will be a community where people are engaged, empowered to make decisions, and work together to build strong neighbourhoods | By 2027 our community will feel engaged and empowered to influence the improvement of their own neighbourhood | | Smart sensor monitoring of Urban activation precincts |
| Prosperous | By 2040 our city will be a diverse and clean economy that attracts investment and jobs, and creates exports in sustainable business precincts while providing | By 2027 we will be constantly ready to adapt to technological advances. We will be better and quicker at sharing relevant information | SAEDB Priority 5- Smart Region Community Energy Hub Adult Education focused on technology | |

| | | | | |
|----------------------------|--|--|--|---|
| | access to education and skills development | | 7 Days in Marion interactive Map for visitors | |
| Innovative | By 2040 our city will be a leader in embracing and developing new ideas and technology to create a vibrant community with opportunities for all | By 2027 our city will see realisation of the full potential of the Tonsley Precinct and other key commercial – industrial-retail zones | Tonsley Innovation Ecosystem – Yellow Pages and Show and Share sessions | Tonsley Precinct as Australia's leading Smart City hub |
| Connected | By 2040 our city will be linked by a quality road, footpath and public transport network that brings people together socially, and harnesses technology to enable them to access services and facilities | By 2027 it will be easier and safer to move around our city which will have accessible services and plenty of walking and cycling paths. New technology and community facilities will better connect our community | <p>Online booking system</p> <p>Fibre connectivity to key sites, supporting free and accessible at public libraries and key sites</p> <p>SEED program – Space for exploring everything digital</p> <p>Dogs and Cats online portal</p> <p>On line tracking of Development Applications</p> <p>Customer event lodgement enhancement</p> <p>Electronic bill delivery to customers</p> <p>MCC ticketing system</p> | <p>Oaklands Smart City Precinct</p> <p>Trial of Smart Lighting in conjunction with the transition to LED lights</p> |
| Organisation of Excellence | | | <p>Upgraded Website</p> <p>Mobility solutions for open space operations workforce</p> | |

| | | | | |
|--|--|--|--|--|
| | | | <p>Community safety mobile applications</p> <p>Digital literacy awareness training for staff</p> <p>Council Agendas and Minutes software</p> <p>GPS fleet tracking expansion</p> | |
|--|--|--|--|--|

**CITY OF MARION
INFRASTRUCTURE AND STRATEGY COMMITTEE
03 APRIL 2018**

Originating Officer: Rebecca Neumann, Senior Environmental Planner

Corporate Manager: Fiona Harvey, Manager Innovation and Strategy

General Manager: Abby Dickson, General Manager City Development

Subject: Coastal Management Plan

Report Reference: ISC030418R10.1

REPORT OBJECTIVES

The purpose of this report is to provide the Infrastructure and Strategy Committee with an update on the progress of the development of the Marion Coastal Management Plan and to seek feedback on next steps.

A 15 minute presentation will be provided for Members by consultant Mark Western, summarising the process for the development of the Stage 1 Scoping Study and preliminary results from Stage 2 data collection and analysis.

EXECUTIVE SUMMARY

The *City of Marion Business Plan 2016-2019*, identifies a priority to “*Plan and deliver a Regional Coastal Management Plan to support effective coastal management*” by 2018/2019 as part of Council’s goal to create a healthy and climate resilient urban environment.

Scoping of coastal management priorities identified the need for Council to have a coordinated understanding of the potential impacts of coastal climate change across the whole coastline. The focus of the Coastal Management Plan is therefore on coastal climate change adaptation.

A detailed scoping study of coastal climate change risk has been undertaken (Attachment 2) along with collection of new data and modelling of climate change impacts. The results of the work so far will be presented to the Infrastructure and Strategy Committee for consideration and feedback.

RECOMMENDATIONS

DUE DATES

That the Infrastructure and Strategy Committee:

- | | |
|---|----------------------|
| 1. Receives a presentation on the Marion Coastal Management Plan and provides feedback on the progress to date and next steps. | 03 April 2018 |
| 2. Notes a draft Marion Coastal Management Plan will be presented to the Committee in June 2018 for consideration. | 05 June 2018 |

BACKGROUND

The last coastal plan developed by the City of Marion was the 1997 *Marion Coastal Strategy Plan*. This broadly focussed plan addressed a range of community and environmental interests in coastal management and resulted in significantly improved public facilities and environmental management – especially through major initiatives such as the Marion Coastal Walking Trail. The actions and strategies from the original coastal plan have since been carried forward into a diverse range of new plans that accommodate coastal considerations including:

- Asset and infrastructure management plans. Including a dedicated plan for the Coastal Walking Trail;
- Hallett Cove Creeks Stormwater Management Plan;
- The Marion Development Plan;
- Hallett Cove Beach Masterplan and Hallett Cove Coastal Processes Study;
- City of Marion Remnant Vegetation Plan; and
- The Resilient South Regional Climate Change Adaptation Plan and associated documents.

In the *City of Marion Business Plan 2016-2019*, as part of Council's goal to create a healthy and climate resilient urban environment, Council identified the need to:

Plan and deliver a Regional Coastal Management Plan to support effective coastal management by 2018/2019

To determine the scope of priorities of this Coastal Management Plan, an assessment of current themes and data gaps in coastal management within the City of Marion was conducted. A common theme emerged around the need for further data and a more coordinated understanding across the whole coastline of the potential future impacts of coastal climate change, particularly sea level rise.

Building on work already completed as part of the Resilient South Climate Change Adaptation Plan, a risk assessment was conducted to identify key risk themes and potential approaches for the development of a coastal climate change adaptation plan. The assessment was completed using best practice approaches recommended by the National Climate Change Adaptation Research Facility (NCCARF) via the CoastAdapt website (www.coastadapt.com.au). This process was written up by NCCARF as a case for use of the CoastAdapt tools (Attachment 1)

The results of this initial testing phase highlighted the need for all current knowledge to be collated into a single location to help inform future risk profiling and planning for future climate scenarios. It was also identified that whilst the Hallett Cove Coastal Processes Study conducted in 2014 provided comprehensive information on coastal processes along Hallett Cove Beach, further information was needed on coastal cliff stability and coastal processes outside of this area, particularly under future climate scenarios.

A coastal climate change planning consultant was engaged (Mark Western, Integrated Coasts) to provide technical advice and direction to support the development of the Marion Coastal Management Plan. This process has been divided into two stages: Stage 1 scoping study and Stage 2 data collection and analysis.

The Stage 1 "Scoping Study" involved a review of the entire coastline of City of Marion in its physical, historical, and strategic contexts. It has quantified what is already known about the Marion coastline, analysed the implications of these findings for current and future times, and also identified what further data is required to more definitively assess the likely impacts of coastal climate change over the course of this century. It creates a foundation to build a coastal climate change monitoring and adaptation plan

The results of Stage 1 Scoping Study have been collated into a working document referred to as the *Regional Coastal Management Plan Stage 1: Coastal Scoping Study* (DRAFT) (Attachment 2).

Stage 2 of the project focusses on collection of new data and associated analysis to provide a more comprehensive assessment of coastal climate risks and vulnerabilities identified in Stage 1. This stage is currently in progress and is due for completion in June 2018.

The most significant data collected in Stage 2 is highly accurate three-dimensional imagery of the whole Marion coastline. This data set establishes a baseline from which to monitor all future changes to the coastal zone. This data will enable Council to model the future impacts of sea level rise and identify areas of particular vulnerability. Through follow-up monitoring, it will also ensure Council can act early on any evidence of change to the structure or stability of coastal cliffs.

Using the baseline imagery, the Stage 2 assessment will also include analysis of past extreme weather events and historic aerial photography to assist with modelling of coastal risks at 2050 and 2100.

Stage 3 will represent the final stage of the project. This stage will include a detailed coastal forward monitoring plan highlighting areas at risk to coastal climate change and suggests adaptation pathways. Funding for this final stage is yet to be finalised in the 2018/2019 Annual Business Plan (see financial impact section below).

All three stages of the project along with their status has been summarised in Table 1 below.

Table 1. Project Plan

| Phase | Step | Deliverable | Start | Status |
|------------------------|--|--|-----------------------|---|
| Initiation | Define scope | Desktop coastal priority assessment Coastal management research Identification of preferred approach | Oct 2016 - Feb 2017 | Complete |
| Detailed Planning | Engage consultant | Consultant brief and project plan | Apr - Aug 2017 | Complete |
| Delivery | Stage 1: Existing data and initial risk assessments | Stage 1 Scoping Study Report (refer Attachment 2) | Aug - Nov 2017 | Complete |
| | Stage 2: Data collection and modelling (Stage 1 recommendations) | <ul style="list-style-type: none"> - Digital elevation model (3D imagery) - Extreme event models - Inundation models - Hot spot erosion analysis - Hotspot cliff analysis | Dec 2017 - June 2018 | In Progress |
| Closure and monitoring | Stage 3: Monitoring and adaptation pathways | Detailed monitoring and response plan based on Stage 2 analyses | July 2018 - June 2019 | Not Started (Funding TBC - New Initiative) |

DISCUSSION

A 15 minute presentation will be provided for Members by consultant Mark Western summarising the process for the development of the Stage 1 Scoping Study and preliminary results from Stage 2 data collection and analysis.

For discussion (15minutes):

- General feedback on the process for development Stage 1 and Stage 2.
- Are there areas of interest / concern around coastal management that you feel need further consideration outside what has been discussed?
- Any feedback on future priorities / next steps (based on Table 1 above)?

Feedback received from the Infrastructure and Strategy Committee will be used to inform the next steps of the project.

ANALYSIS

Consultation

The Stage 1 Scoping Study was completed in consultation with key internal staff and staff from the Coast Protection Board and Flinders University. The Coast Protection Board have confirmed their support for the approach.

Communication

The approach used in the Stage 1 Scoping Study was presented at the South Australia State Coastal Conference and has been discussed at the Metropolitan Seaside Councils Committee. Positive feedback has been received from other Councils and the Local Government Association on the approach taken.

This approach is now being considered to support coastal climate change adaptation planning by several other regional and metropolitan Councils.

Legal/Legislative and Risk Management

The scoping study provides a context for Council to understand its risk profile and legal obligations in coastal climate adaptation.

The risk assessments conducted for each of the sections of the Marion coastline were conducted using the same risk criteria as used in the *City of Marion Enterprise Risk Framework*.

Financial Implications

Completion of stage 3 of the project was prioritised for inclusion of \$15,000 in the 18/19 Draft Budget (GC130318R09). Future delivery of the Coastal Management Plan will require funding for an ongoing monitoring program as well as funding for future remedial / adaptation action.

CONCLUSION

Stages 1 and 2 of the Marion Coastal Management Plan provide a thorough assessment of the City of Marion's exposure to coastal climate change risk using best practice methodology.

Overall, the City of Marion is at low risk to impacts from coastal climate change in the short term, however there are a number of hot spots identified in the plan that will need further monitoring. It is expected that adaptation action will be needed in these areas over the next 20 years.

It is recommended that further detail on the coastal monitoring program and adaptation pathways be presented to Council in June 2018 for consideration.

APPENDICES

Attachment 1: NCCARF Snapshot: *“Testing the waters: Coastal management planning in the City of Marion.”*

Attachment 2: *“Marion Coastal Management Plan - Stage 1 Scoping Study”* working draft prepared by Integrated Coasts.

Presenters

Rebecca Neumann, Senior Environmental Planner

Mark Western (Integrated Coasts) coastal planning consultant



Snapshot

Testing the waters: Coastal management planning in the City of Marion

Summary

The City of Marion forms part of a nationally recognised climate change adaptation planning alliance known as Resilient South, which comprises Adelaide's southern region and includes the cities of Marion, Holdfast Bay, Mitcham and Onkaparinga. Through this initiative, these cities have mapped their climate change hazards, vulnerabilities, risks and adaptation pathways.

The City of Marion has been using CoastAdapt to take a coastal focus on the already strong foundation established by Resilient South. Data collected by the initiative as part of an integrated vulnerability assessment are being used to develop more detailed second and third pass assessments of climate risk along Marion's coast. These risk assessments will be incorporated into the Council's broadly focussed Coastal Management Plan.

The City of Marion is located within the Adelaide metropolitan area, covers 55 km² and has a population of about 88,900 people. The City's coastline extends 7.2 km and includes the coastal suburbs of Marino and Hallett Cove, home to around 15,000 people. Marion's coastal environment is unique in the metropolitan area as it has rocky cliffs and small sandy coves (see Figures 1 and 2). It features two State conservation parks (see Figure 3), world famous geological formations, important sites of remnant coastal vegetation and the significant cultural presence of the Kaurna Tjilbruke Dreaming.



Keywords

City of Marion, metropolitan, integrated vulnerability assessment, Resilient South, risk assessment, test case

Figure 1: The rocky coastline of the City of Marion as seen by helicopter. Source: © City of Marion.



Figure 2: A view of the City of Marion coastline from helicopter. Source: © City of Marion.



Figure 3: Visitors enjoy the walking trails through the Hallett Cove Conservation Park. Source: © Marilee Campbell.

The City of Marion has taken a proactive approach to climate change adaptation through a regional council alliance called Resilient South. Significant work has already occurred through Resilient South, which means that the Council and the community have a good understanding of both coastal and non-coastal climate vulnerabilities and risks. They have also worked together to develop regional adaptation pathways to guide future action.

Building on the work already achieved through Resilient South, and some targeted coastal studies, the City of Marion is now working to identify site and asset specific vulnerabilities in its coastal zone, and to develop a more detailed understanding of localised risk and actions needed to support effective coastal management.

In this context, and as part of a test case supported by NCCARF, the City of Marion used CoastAdapt's Climate Change Adaptation Decision Support tool ([C-CADS](#)) to plan and undertake detailed second and third pass risk assessments of coastal hazards.

A key activity of the test case was a half-day workshop conducted with staff from across the Council that represented a diversity of operational areas: assets and infrastructure management, community development, strategic planning, development assessment planning, environmental planning and sustainability, and economic development. The staff members were asked to discuss the ways in which climate change might be expected to affect the Council's coastal systems at risk (see Figure 4). These systems had been previously identified as part of an Integrated Vulnerability Assessment conducted through the Resilient South project and are the following:

- beaches
- cliffs
- coastal shrubland (including threatened species)
- pest plants and animals (terrestrial)
- near-shore marine environment
- cultural heritage
- Council assets
- surface water management
- private property
- provision and access to recreation facilities
- geological monuments
- community (resident population and visitors).



Figure 4: Workshop attendees discussing the risks climate change poses to the City of Marion in breakout groups. Source: © Marilee Campbell.

During the workshop, the breakout groups were presented with maps that identified assets and familiar local sites, and participants worked in small groups to identify broad risks. Of particular value was the diverse range of interests and expertise represented at the workshop. Landscape architects and development engineers brought technical expertise while community engagement and public art planners offered perspectives on community values.

The cross-organisational discussion in the workshop setting produced an exhaustive list of potential risks. Using the C-CADS framework from CoastAdapt, the greatest risks were identified and analysed in greater detail. Some of the risks that were considered 'High' or 'Extreme' included:

- the locations where dunes and embankments had been eroded in recent storm surge events, which had exposed contamination and sensitive underlying claybeds
- local sites where stormwater infrastructure was already at capacity and failing under extreme rainfall events

- local sites that were experiencing clifftop 'gullyng'
- specific infrastructure that could be at risk in the event of extreme events in the future
- local sites and subjects that need more data to better understand the level of risk – e.g. the effects of sea-level rise on cliff stability.

The City of Marion plans to continue to use the risk assessment tools and resources in CoastAdapt to deepen its understanding of coastal climate change and to prioritise on-ground action and identify areas where further information or regional collaboration is needed.

The results of the CoastAdapt test case will assist the City of Marion with the development of a Coastal Management Plan and will help to further discussions with regional partners and agencies around responsibility for coastal action and strategic prioritisation of funding.

Further reading

All links accessed 16 June 2017:

The City of Marion's website: www.marion.sa.gov.au.

The Resilient South regional climate change adaptation plan, prepared by URPS and Seed Consulting Services as part of the Resilient South project: www.environment.sa.gov.au/files/sharedassets/public/climate-change/regional_adaptation_plans/resilient-south-climate-change-adaptation-plan.pdf.

The Resilient South southern region local government implementation plan 2015-2019, prepared by the Cities of Onkaparinga, Holdfast Bay, Marion and Mitcham in association with the South Australian Local Government Association: <http://www.onkaparingacity.com/public/download.jsp?id=78357>.

The Resilient South project's website: www.resilientsouth.com.

This Snapshot was prepared by Rebecca Neumann and Natalie Iglio from the City of Marion as part of a series of test cases conducted to assess CoastAdapt's performance and utility in real life adaptation situations. A special acknowledgement goes to Nicole Halsey of Urban and Regional Planning Solutions (URPS) who also contributed valuable feedback to the test case.

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NCCARF

National
Climate Change Adaptation
Research Facility



Australian Government

Department of the Environment and Energy



Note: This report represents the findings from Phase 1 of the project and should be read as a 'work in progress'. Phase 2 of the project includes an analysis of the coastline using a digital model captured and created by Aerometrex. The findings will be brought together in a final scoping study report.

City of Marion

Regional Coastal Management Plan

Stage 1: Coastal Scoping Study (DRAFT)



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This document is the output from *Coastal Scope*, which is a coastal scoping tool developed by Integrated Coasts. This document is for exclusive use by City of Marion Council written to guide the development of a coastal adaptation plan. To obtain permission to transmit this document to others, please email mark.western@integratedcoasts.com.

Front Cover

https://upload.wikimedia.org/wikipedia/commons/f/f1/Hallett_Cove_P1000736.jpg

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Executive Summary

The purpose of this scoping study was to review the entire coastline of City of Marion in its physical, historical, and strategic contexts, from which to create a foundation to build a coastal climate change monitoring and adaptation plan. The study has quantified what is already known about the Marion coastline, analysed the implications of these findings for current and future times, and also identified what further data is required to more definitively assess the likely impacts of coastal climate change over the course of this century.

This scoping study forms the first step of a formal coastal planning process developed by Integrated Coasts. This adaptation planning approach builds on best practice methodology identified by the *National Climate Change Adaptation Research Facility* via *CoastAdapt*, as well as the *Coastal Adaptation Decision Support Pathways Project* developed by the South Australian Local Government Association. The coastal scoping methodology utilised in this study and the recommendations of this report have been reviewed and endorsed by the Coastal Management Branch at Department of Environment Water and Natural Resources (DEWNR).

Background

The development of a Coastal Management Plan has been identified in the City of Marion Business Plan 2016-2019 as part of the broader goal for “a healthy and climate resilient urban environment”. A draft Coastal Management Plan taking a broad integrated coastal zone management (ICZM) approach, is currently in development. A key aspect of this plan is to provide direction around coastal climate change adaptation and therefore this study represents a key component of Coastal Management Plan.

Council’s overall approach to climate change adaptation is framed by the *Resilient South Climate Change Adaptation Plan* which has provided a general framework to understand climate change adaptation needs and priorities across Adelaide’s southern region. The City of Marion is currently working with a broad range of government, community and industry partners to implement the plan across four regional foundation projects. A climate change policy has also been adopted by the City of Marion to support integration of climate change principles into local council operations.

Several studies and plans have already been completed by the City of Marion that provide direction for future coastal management planning. For example, the *Hallett Cove Coastal Management Study 2012* (HCCMS) provides a thorough review of the coastal processes for the Marion Council region.

Coastal adaptation context

The primary coastal climate change hazards taken into consideration as part of this study are sea level rise, associated erosion, and possible changes to rainfall patterns.

Conversely, the receiving environments considered in this study, upon which these hazards may impact, are: public infrastructure, private infrastructure, and public safety. The impact upon coastal ecosystems is also considered but in a more general sense as to the potential for an ecosystem as a whole to become ‘disrupted’ over time from rising sea levels and associated erosion¹.

¹ The concept of ‘ecosystem disruption’ is found within the Coastal Hazard Wheel methodology that has been recently released by United Nations Environment Program. The Coastal Hazard Wheel manual, *Managing Climate Change Hazards in Coastal Areas*, notes that the potential for ecosystem disruption exists in more protected coastal ecosystems as these environments ‘frequently host

South Australian Coast Protection Board policy provides the statutory context in which coastal planning and adaptation is undertaken in this State. Coast Protection Board has set sea level rise policy levels at 0.3m, indicatively by 2050, and 1.00m indicatively by 2100. In this study, the longer-term context of 2100 has been utilised because long-term thinking is required in the context of urban infrastructure where decisions have long-lasting effects.

For the purposes of this study the 7km coastline was segmented into five regions in accordance with underlying geological types: *Marino Cliffs, Hallett Cliffs, Hallett Beach, Field River, and Southern Cliffs*. First, a desktop study was conducted to establish the historical and statutory contexts, and then a coastal tour was undertaken on foot and from the air. Preliminary risk assessments, using standard risk methodologies based upon *National Emergency Risk Assessment Guidelines* and *CoastAdapt*, are provided in this report for the purpose of identifying and categorising coastal risks and adaptation issues.

Summary Findings

In general, the overall vulnerability of the City of Marion to coastal climate hazards is low, due to the dominance of rocky cliffs with low erodibility. There are some areas however that are at increased risk due to low elevation and/or erodible shorelines. Erosion problems are already being experienced at Hallett Cove Beach where the slope separating Heron Reserve from the beach is coming under attack during storm events. Throughout the study tour, some erosion was observed at the base of the cliffs, but overall the assessment suggests that most of the cliff environments are not under constant attack from wave action. However, the consequences of cliff failure are significant, and therefore these cliff environments require further scrutiny, especially in the environment of sea level rise where wave action is expected to increase at the base of the cliffs.

Within the next 100 years, inundation is unlikely to occur for most of the coastline however there is a higher likelihood at the northern border of Council, and within the Field River area in the south.

More specifically, within the ***Marino Cliffs*** section, significant infrastructure is situated close to cliff escarpments (Marine Parade and Marino Rocks carpark). Observed erosion at the base of the steep slope adjacent to the carpark suggests that further assessment is required. Anecdotal evidence indicated that The Esplanade at the northern border of the Council may be subject to inundation.

Observation from the scoping tour revealed that most of the coastline within the ***Hallett Cliffs*** region is not subject to constant wave action at the cliff base. However, the road reserve and housing is set close to the cliff escarpment at The Esplanade and Clifftop crescent. A land slip in 1996 in this region indicates that land slip events are possible however investigation at the time indicated that this event was isolated and that there was a low likelihood of it reoccurring under current conditions. Observation of the cliff base of this region confirms that high water events are beginning to erode the base in this land-slip area and future risk under climate change may need further investigation.

Hallett Cove Coastal Management Study (HCCMS) was positive regarding the prospects of the dune system at the northern end of ***Hallett Cove Beach*** adjacent to the Hallett Cove Conservation Park. However, storm water has recently started eroding three channels through the dunes. Rising sea levels may result in seawater intrusion into these channels, and these dunes would degrade more quickly than anticipated.

In the southern section of Hallett Cove Beach, HCCMS reviewed erosion of the constructed embankment at the base of Heron Way Reserve. It was identified that protective works will be needed to minimise erosion and threats to infrastructure at the base of Heron Way Reserve. The storm event of 9th May 2016, caused erosion and undercutting at three locations along this

embankment. These sites have been battered to stabilise the earth. The Heron Way Foreshore Masterplan has identified options for further protective works along the beach.

The **Field River** area is likely to be susceptible to inundation over time. HCCMS suggests that rising sea levels will erode the sand dune to the north of the river, and the sand spit to the south of the river. Private and public infrastructure situated behind these dunes are likely to come under threat over time.

The **Southern Cliffs** area to the south of Field River is the least susceptible of all the study sections to coastal processes. All infrastructure is well set-back from the cliff escarpments. HCCMS recommended that storm water management be reviewed, and that the bases of the cliffs are monitored.

Recommendations

Recommendations that flow from this scoping study are mainly concerned with obtaining the data from which to more accurately quantify the current and future impacts. The recommendations are:

1. Obtain a digital elevation model (DEM) for the coastline. First, it is essential to establish a baseline in the cliff and beach environments to measure change over time. Second, sea level rise impacts can be modelled in the DEM, and this will provide essential insight into the likely future action of the sea at The Esplanade (Marino), cliff bases, the beach, and Field River.
2. Analyse the May 9th event and recreate this event in the DEM. This event will provide an insight into the impacts of a storm surge event along the entire coast of council, and in turn will provide the basis for extrapolating future events in the context of sea level rise. This analysis will also provide insight to the causes of the erosion observed in some locations.
3. Conduct photographic analysis to ascertain historical erosion rates. Ascertaining the erosion rates for cliff top, beach, and river areas will assist in assessing the timing of future risk.
4. Conduct a preliminary geological assessment of cliffs. This should be a low-cost study to provide technical assessment into the stability of the cliffs, especially in locations where infrastructure is situated near cliff tops.
5. Conduct storm water audit of all outlets into coastal regions. It is understood that the Council has this information readily available, and that remedial works have been undertaken in many places. However, storm water impact should be further assessed in the context of coastal adaptation.
6. Progress further with the Coastal Scope planning approach to further assess risks, identify adaptation pathways and develop a monitoring program.

Introduction

0.1 Coastal Adaptation Strategy

Over the last few years, Integrated Coasts has been a key architect in developing and utilising the Local Government Association's *Coastal Adaptation Decision Pathways* tool². The tool has been successfully used in major coastal adaptation studies for eight settlements around Gulf St Vincent. Based on experiences gained in these studies, and having researched emerging coastal adaptation practice, Integrated Coasts has adopted an amended approach based on three principles.

1. Coastal adaptation takes place in localities.

In comparison to other climate change hazards, sea-level-rise, and associated erosion, is unique. For example, a uniform increase of temperature of 1-2 degrees will uniformly affect a region such as the Fleurieu Peninsula. In contrast, a uniform increase of sea level of 0.5m is likely to produce a vast array of impacts, even within a ten-minute walk along the coast. The reason for the difference in the way that the hazards are experienced is that the impact of sea level rise (and associated erosion) is dependent like no other on the thresholds and tipping points that the geological layout presents at each location. Furthermore, the fabric of the geology, the bathymetry of the sea-floor, and the orientation of the coast to wind and wave exposure, all act as modifiers in the way in which sea level rise and associated erosion are experienced. Therefore, coastal adaptation must take place in a fine-grained way that takes the unique nature of sea level rise impact into account. This principle does not infer regional responses are not warranted, but rather that the methodology we employ must fine-grained and local.

Integrated Coasts has developed a low-cost scoping methodology that will:

- Partition the coastline in accordance with geological features (using standardised nomenclature),
- Scope these partitions and provide preliminary general assessment of risks and vulnerabilities, but also identify 'hotspots' for particular assessment,
- Identify what data is required to more accurately assess vulnerability and adaptation option.

2. Coastal adaptation is on ongoing process.

What is known as 'pathways' adaptation methodology is the preferred way to undertake coastal adaptation. A pathways approach recognises three main ingredients: uncertainty, time, and triggers or thresholds. All of these ingredients are inherent features of coastal adaptation. A 'pathways' approach also infers the use of 'scenario planning' that identifies plausible futures from which to identify key thresholds and triggers, and then to consider alternative pathways when these are breached. The methodology also infers that monitoring of thresholds will be a main part of the adaptation plan, and not just a minor step in an adaptation study. And finally, a pathways approach infers the creation of a baseline. In ten, twenty or fifty years, on what basis will a determination be made about the rate of erosion, unless we have created the baseline now from which to compare change?

²Balston, J.M., Kellett, Western, M, J., Wells, G. Li, S., Gray. (2012). *Climate change decision support framework and software for coastal Councils*, Local Government Association of South Australia, Adelaide, SA, and Western/Kellett (2014) *Dealing with sea level rise on coastal assets*, PPT tool.

The *Coastal Scope* tool recognises that coastal adaptation is a process that will take place over decades, and even centuries, and therefore:

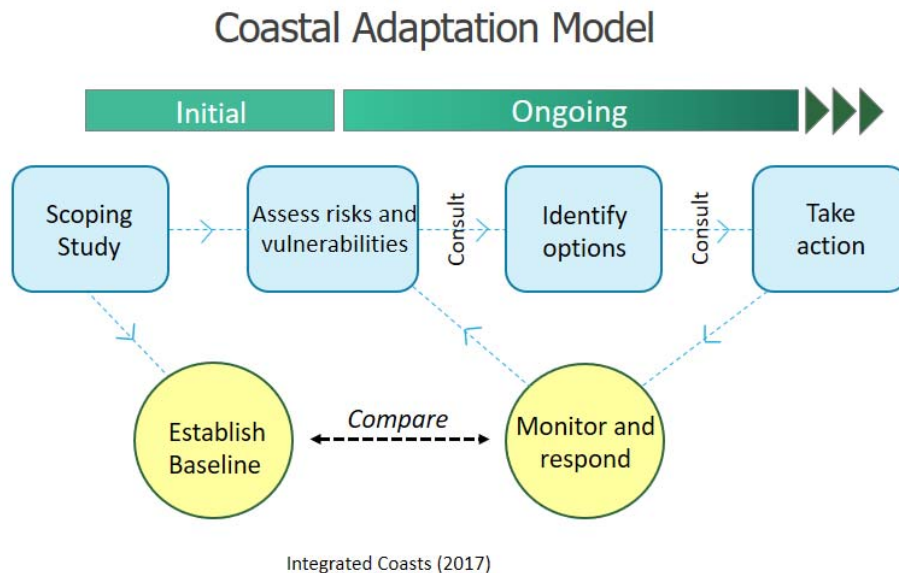
- establishes a current baseline (within a digital environment),
- utilises scenario planning using best available science to envisage plausible futures,
- recognises that monitoring will be a main feature of the coastal adaptation program both to take into account changes in the science, but also changes in the coastal zone.

3. Coastal adaptation should be initially 'data-driven'.

Community engagement is best sought once the physical context of adaptation has been established as outlined in (2) above. The first steps in any coastal adaptation process should be to identify the physical baseline, then to conduct scenario analysis to identify plausible futures, and then to communicate these realities to the community. This principle ensures that community engagement is based on informed decision making, and that community expectations are managed as much as possible within physical realities. If all stakeholders have a shared understanding of the local context then it is more likely they will work together to arrive at common solutions. Therefore, this scoping study does not include any consultation with the community, but rather focusses on identifying and analysing existing data, or makes recommendations and takes steps to acquire data deemed necessary to more fully describe the physical coastal adaptation issues.

These three principles are effectively illustrated in the diagram below.

Figure 1: Coastal adaptation model (Integrated Coasts)



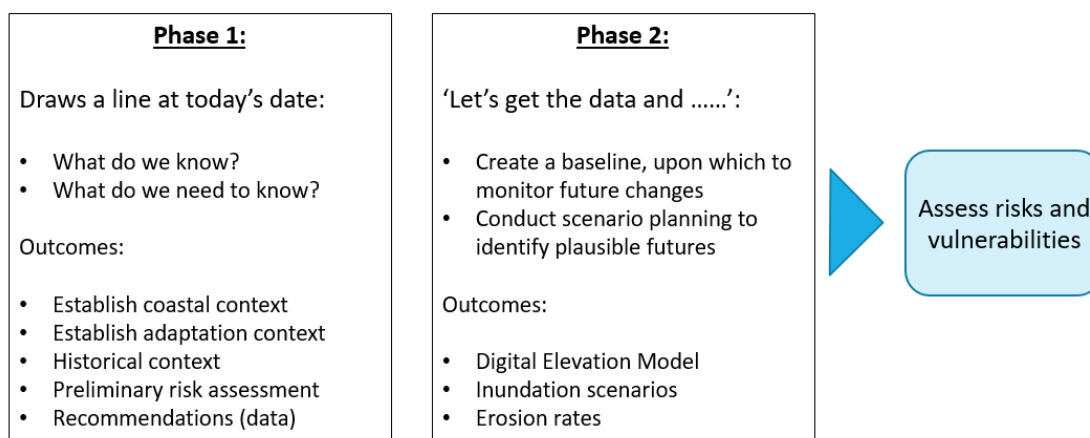
0.2 Coastal Scope

Taking into account the coastal adaptation strategy outlined above, the scoping study is the first stage in the strategy. The *Coastal Scope*® tool is designed to:

1. Identify the coastal climate adaptation context,
2. Formulate the framework and scope for coastal adaptation study,
3. Conduct a coastal tour to identify the key coastal issues in the region,
4. Provide preliminary assessment of key adaptation issues,
5. Provide the basis for the Council to obtain further funding for specialist areas of study.

The scoping study is conducted in two main phases that culminates with an assessment of risks and vulnerabilities (Figure 2):

Figure 2: The two phases of the scoping study



Phase 1 is the most intensive phase and consists of the following steps:

Step 1: Partition the coast in accordance with geological layout

To facilitate effective study and cohesive risk assessment, the coastline is partitioned into study sections according to geological layout.

Step 2: Establish the context

This section of work is a thematic study around five contexts:

- Coastal context

Impacts experienced in the coastal zone are a product of how actions of the sea (tides, wave action, sediment movements and storms) combine over time with the physical features of a coastal area (geology and vegetation). Identifying these features in the coastal zone of the Marion Council is the first step in framing the study.

- Climate adaptation context

Changes in coastline profiles have been occurring slowly for thousands of years and human society has always had to adapt to those changes. However, over the last century the rate of change in sea level and associated erosion has escalated, and that rate of change is

projected to escalate significantly more by the end of this century. These trends suggest that significant adaptation will be required within the coastal zone. This section of the study explains the context in which this adaptation will take place.

- Strategic context

Within the contexts described above, humans reside, work and recreate. Governments are responsible to manage how humans operate in the context of the natural environment (land use planning and assessment), and are responsible for the safety and well-being of people. Reviewing the strategic context in which Marion Council operates will provide the context for the way in which any changes (adaptation) is to be empowered over time.

- Historical Context

The historical context provides a window into the past. Previous storm events provide a context for understanding current processes and risks. Photographs and community stories provide a context to understand how the coast has changed in the recent past and this will assist in framing the future.

- Technical Context

Previous studies provide technical input. Digital Elevation Models may also exist for a region that can be used in 'scoping mode' to prioritise larger coastal adaptation studies and actions.

The *Coastal Scope* tool brings all these strands should be brought together into one place, as a foundation for future coastal adaptation study and work.

Step 3: Conduct a coastal tour

A coastal tour of the coastal environs is conducted using the *Coastal Scope* app, Google tools, drone survey, and walking surveys. The coastal tour adds to the knowledge base by:

- Locating existing protection works and strategies,
- Identifying any assets that are likely to be under threat,
- Identifying evidence for inundation, or erosion of dunes and cliffs,
- Identifying locations that may be subject to coastal processes in the future.

Step 4: Conduct assessment

This section of work considers the findings of Steps 1 - 3, identifies specific data and/or knowledge gaps, and provides a preliminary assessment of key vulnerabilities and risks. An inherent hazard rating is assigned to each coastal section according to geological layout using the methodology explained in Coastal Hazards Wheel³ (CHW). In addition to that process, risk assessment procedures similar to the City of Marion's Risk Management Framework are utilised to further quantify / qualify risk. The preferred way to complete risk assessments is to conduct a workshop with key personnel from Council to consider the findings from the previous two steps. However, whether a risk

³ United Nations Environmental Programme (2016) Managing climate change hazards in coastal areas

assessment workshop is run within Phase 1 or Phase 2 of the scoping study may be dependent on the level of data available within Phase 1.

Step 5: Propose Recommendations:

Step four recommends the preferred course of action for the Council to complete Phase 2. Normally, this will entail obtaining more data.

0.3 Background to this project

The Southern Adelaide region (Holdfast Bay, Mitcham, Marion and Onkaparinga Councils) have cooperated together to produce the Resilient South Climate Change Adaptation Plan (2014). Resilient South, as a regional climate adaptation planning process, has utilised 'higher-level' integrated vulnerability assessments that has provided a general framework to understand climate change adaptation needs and priorities in the region.

Figure 2: Southern Adelaide regional area



Source: Resilient South – climate change adaptation plan

Future coastal adaptation planning will require a more fine-grained approach because coastal impacts are felt at a very local level, whereas other climate change impacts are felt more regionally.

Due to the particular localised nature of coastal adaptation, it is recommended that a 'bottom up', finegrained approach is utilised in coastal adaptation, rather than a regional 'top down' approach. This localised approach does not infer that coastal adaptation should not be conducted as a regional enterprise. Regional approaches may seek to encourage uniform coastal adaptation study methods to provide consistency.

0.4 Hallett Cove Management Plan

One of the purposes of *Coastal Scope* is to identify previous studies and management plans to ensure that future adaptation work is built on the foundation of past work. However, in this project, the Hallett Cove Management Plan⁴ should be brought forward as the centre piece of any adaptation work. Although the focus of the study is limited to the Hallett Cove Beach area, this study has drawn together a vast array of previous studies that identify the coastal processes that will apply to the entire Marion Council coastline. Therefore, this scoping study will rely on that study where it speaks about coastal processes, and the report is appended (Appendix 1).

The Hallett Cove Coastal Management Study (HCCMS) canvases coastal adaptation options for addressing climate change impacts in the Hallett Cove Beach region and recommends that,

A detailed coastal management strategy/plan needs to be finalised and adopted by the City of Marion, identifying the preferred management approaches for each coastal section and identifying triggers/timelines for implementation. Funding requirements should be identified and included in Council's long-term financial plan....The plan and identified future risks should apply across all areas of Council operations (p. 79).

The Hallett Cove Coastal Management Study (HCCMS) also recommends as a high priority that a programme and methodology for monitoring coastal change is adopted to determine changes over time. HCCMS views monitoring as,

...essential for assessing the impacts of sea level rise and the rate of retreat of the back-beach escarpment and to identify the need for implementation of elements of the coastal management strategy. It is recommended that long-term beach profiles be established in discussion with the Coast Protection Board (CPB) to ensure future monitoring builds on the beach profiling and photographic record they have already established. An additional monitoring program should be developed jointly with the CPB and the community to formally collect and collate data of the beach changes. A likely strategy could include approximately two beach cross-sections (surveyed) and these be augmented with more regular annotated photographs of the beach state or specific areas of interest, building a longer-term database of the area.

HCMP also notes the need for bathymetric modelling of the coastline and recommends that the assistance of CPB be sought to complete this work.

0.5 Future study areas.

The purpose of this project is to conduct a preliminary scoping study and therefore the scope and range of the project is to be contained as much as possible. The focus of the study is to identify and document any significant coastal climate change risks in the City of Marion with the view to identifying future adaptation pathways relevant for consideration as part of council operations.

It acknowledged that coastal climate change may have hazards affecting other coastal systems such as terrestrial and marine ecology and changes in coastal culture and heritage, and further study is likely to be required subsequent to this scoping study

⁴ Lord, D 2012, Coastal Management Study – Hallett Cove SA, Coastal Environmental Pty Ltd

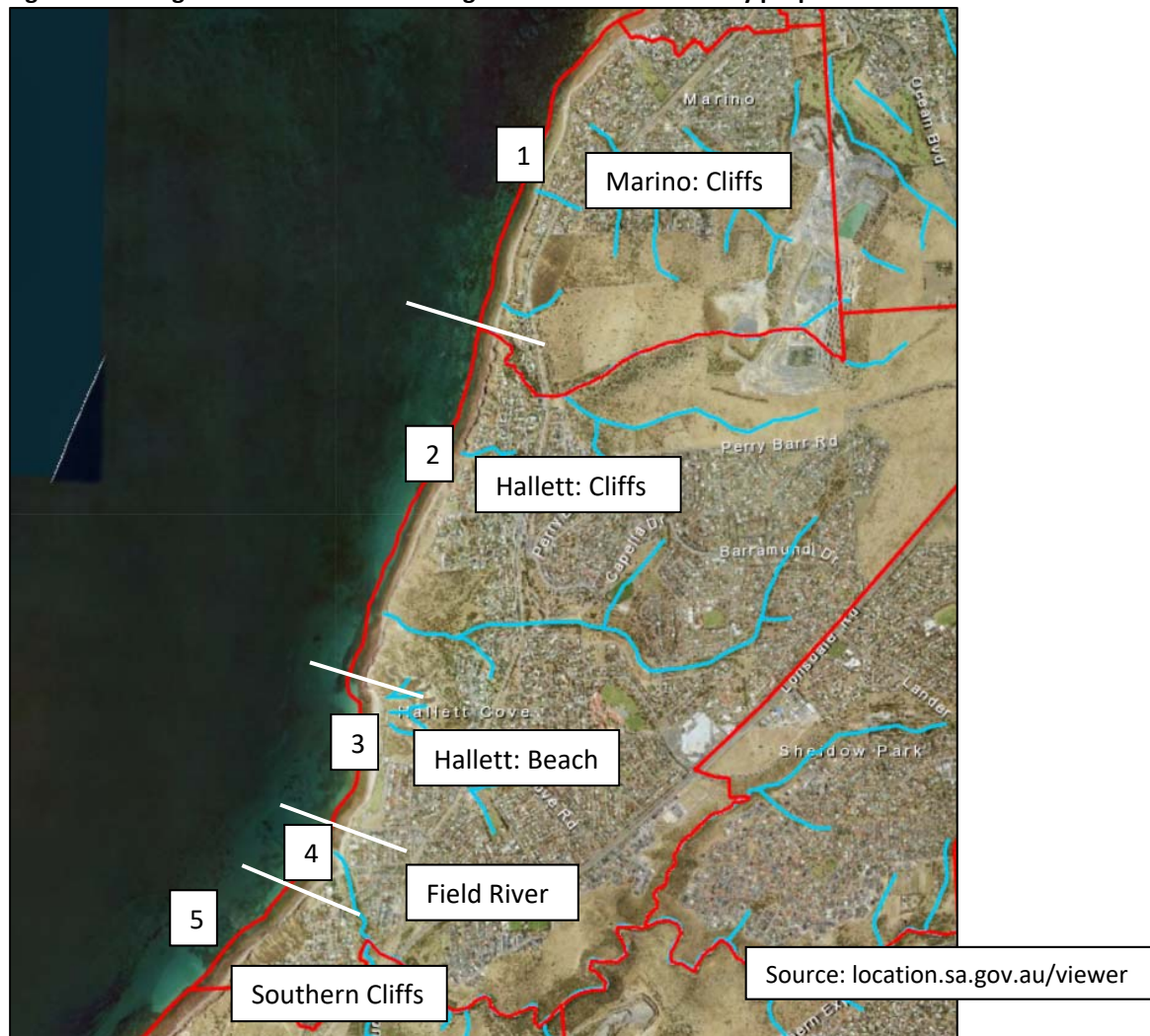
1. Partition the coastline according to geological layout

The United Nations Environment Program (UNEP) has developed a simple coastal hazard classification system that is accessible to different coastal management levels, scientists, and policy-makers. The Coastal Hazard Wheel (CHW) system uses a simple standardized universal coastal language and is therefore well-suited as a general information and decision-support system that can be supplemented with other available methods and models when considered appropriate⁵.

The CHW method begins by assigning geological layout categories to sections of the coastline. In locations where the characteristics of the coastline change frequently, classifications may change every few hundred metres, whereas in places where the coastal type extends for many kilometres a single classification may apply. The geological layout categories used in the system include: *sedimentary plain, barrier, delta/low estuary island, sloping soft rock coast, flat hard rock coast, sloping hard rock coast, coral island, tidal inlet/sand spit/ river mouth*.

To facilitate the scoping study the City of Marion coastline is broken into study segments that reflect these geological assignments (Fig. 3). See also Figure 7 for assessment of geological features (p.13).

Figure 3: Geological context and sectioning of the coastline for study purposes



⁵ Rosendahl Appelquist, L. Balstrøm, T., & Halsnæs, K. (2016). Managing climate change hazards in coastal areas: The Coastal Hazard Wheel decision-support system. United Nations Environment Programme, p. 1

2. Establish the adaptation context

2.1 Coastal Context

Impacts experienced in the coastal zone are a product of how actions of the sea (tides, wave action, sediment movements and storms) combine over time with the physical features of a coastal area (geology and vegetation). Identifying these features in the coastal zone of the Marion Council is the first step in framing the study:

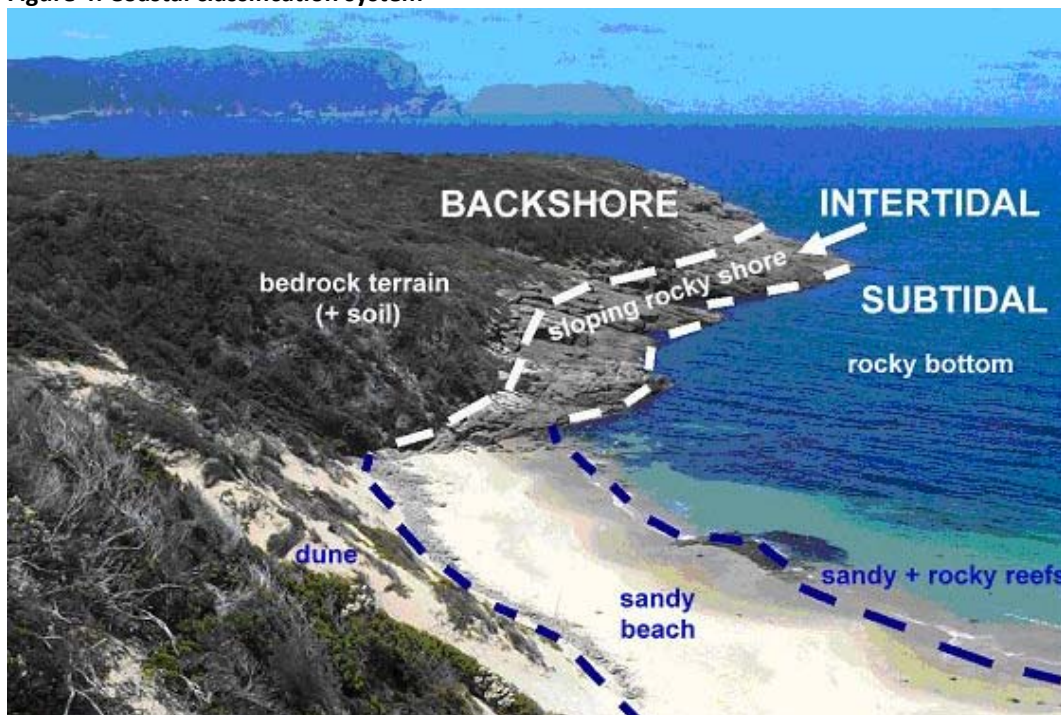
- Geology
- Wave exposure
- Tidal range
- Sediment balance
- Vegetation
- Stormwater outflow

This section of the study uses assessment categories from the United Nations Environment Programme's, Managing Climate Change Hazards in Coastal Areas, but omits 'storm profile' (as this relates to tropical regions) and includes 'stormwater outflow'⁶.

2.1.1 Geology

In simple terms, the geomorphology of coasts is classified in three main parallel zones (Figure 4). The intertidal zone in the centre consists of the area between low and high-water marks. The backshore is typically characterised as up to 500m to the land side of the intertidal zone⁷.

Figure 4: Coastal classification system



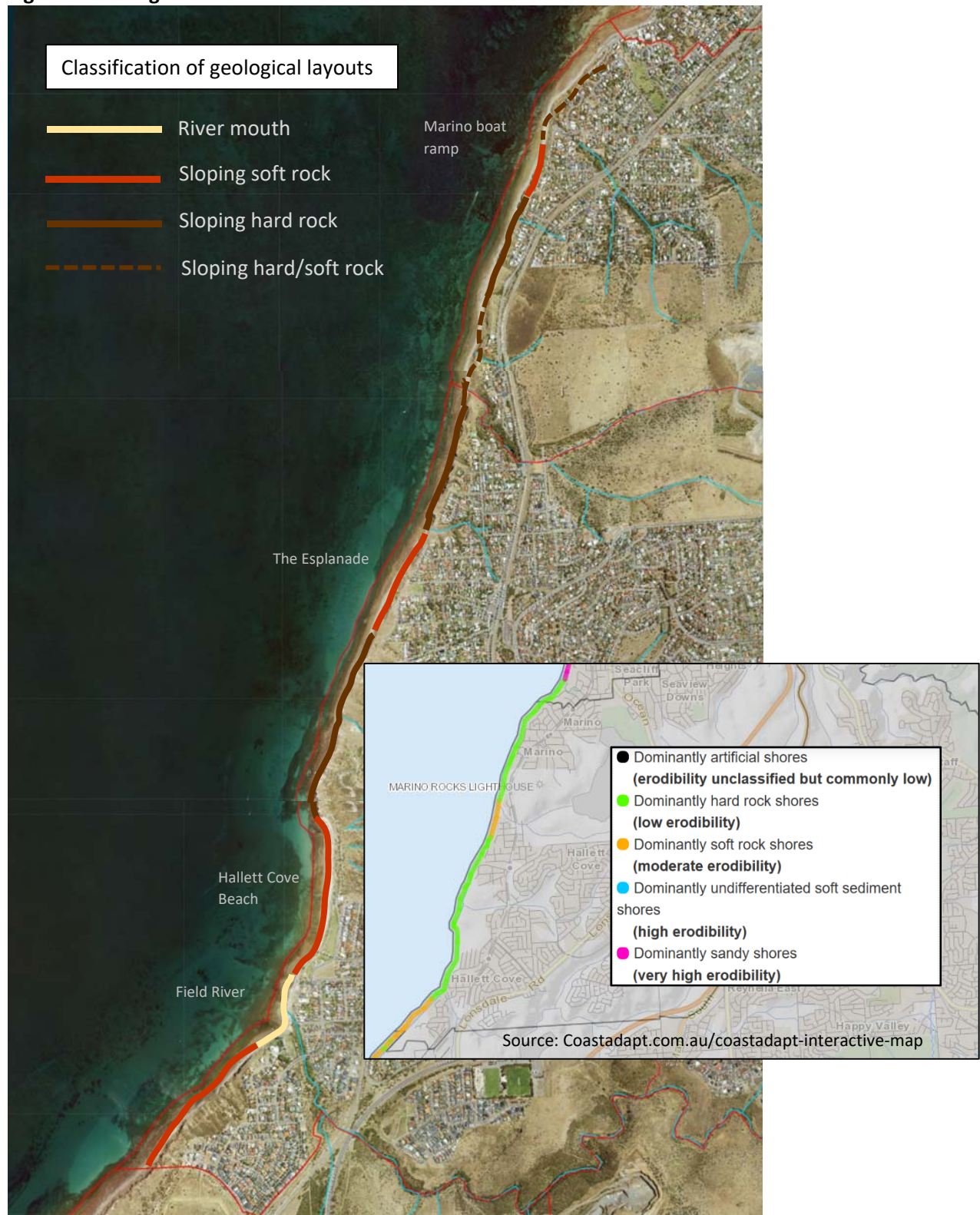
Source: Geoscience Australia, Ozcoasts

⁶ One of UNEP's aims in developing CHW was to provide a universal language around coastal adaptation, and therefore this study intentionally adopts introductory text from the CHW manual.

⁷ <http://www.ozcoasts.gov.au/coastal/introduction.jsp>

In more comprehensive studies, these three coastal zones are all assigned a category, and sometimes also sub-categories. In this study, a simple classification is assigned based on Coastal Hazard Wheel methodology (Figure 5). Assignments of classes have been made using Google Earth, site visits, and comparison with other resources such as Smartline (inset) as depicted in CoastAdapt.

Figure 5: Geological classifications



Source: location.sa.gov.au/viewer

Preliminary assessment

To facilitate study within geological layout types, the Marion Coastline has been partitioned (Figure 3) in accordance with geological layout according to the classification in Figure 5. The Marion coastline is predominantly a combination of 'sloping hard-rock shores' and 'sloping soft-rock shores'. The Field River area is assigned as 'river mouth'. Hallett Cove Beach does not fall into 'sedimentary plain' classification, and is thus also assigned 'sloping soft-rock shores'.

Generally, the elevated geology of the Marion Council coastline has features that make it less vulnerable to inundation. The Field River area is the exception as a river mouth. The extensive areas of cliff categorised as *sloping hard rock shores* suggest that large sections of the coastline may not be subject to erosion. Areas categorised as *sloping soft rock shores* such as Hallett Cove Beach are more likely to be vulnerable to erosion.

The HCCMS has effectively described the geological circumstances for Study Sections 3-5 of the coastline and provided an assessment of how landforms might perform over time in relation to climate change impacts (Appendix 1, pp 10-13). A broad geological description of the Marion coastline is provided in Coastal Landscapes of South Australia (Bourman *et al.* 2016) and a detailed description for the Hallett Cove areas described by the Field Geology Club of South Australia & Giesecke (1999).

Future Assessment

A coastal adaptation study should engage a geological specialist to quantify the landforms in Sections 1-2 and to quantify in further detail how the landforms in these sections might perform in a changing climate over extended periods of time.

2.1.2 Wave Exposure

Synopsis⁸:

The wave exposure is the prime energy source in the nearshore environment and a highly important parameter in the consideration of coastal geomorphology⁹. Although some incoming wave energy is reflected by the shoreline, most energy is transformed to generate nearshore currents and sediment transport and is therefore a key driver of geomorphological change. The height of the wave, defined as the difference between the wave crest and wave trough is the generally applied measure for assessing incoming wave energy. Coastal environments with high wave heights have higher energy intensity compared to coasts with lower wave heights because wave energy increases as the square of the height of the wave.

The main type of waves affecting a coastal system are 'gravity waves generated by wind stress on the ocean'. Gravity waves are generally composed of both sea waves and swell waves. 'Sea waves are formed under direct influence of the wind on the ocean surface and have peaked crests and broad troughs'. Sea waves are often complex with 'multiple superimposed sets of different wave sizes and whitecaps can be present during high wind speeds'. Swell waves develop when the wind ceases and when waves travel outside the area where the wind is blowing. Whether a coast is primarily affected by sea or swell waves is largely determined by coastline geography and the general climatic conditions of a region.

The CHW applies a wave environment perspective and distinguishes between *exposed*, *moderately exposed* and *protected* coastlines based on the wave height. The simplified way of estimating the wave exposure makes use of information on the general wave climate, the waterbody size (fetch length) and the wind conditions (Table 1).

Table 1: Wave exposure classification

| General wave climate | Waterbody size (fetch length) | Specific coastal conditions | CHW classification |
|---|-------------------------------|---|--------------------|
| Swell wave climate (West coast swell, East coast swell, Trade/monsoon influences) | Any | Extreme swell (West coast swell south of 30°S) | Exposed |
| | | Swell | Moderately exposed |
| | | Backbarrier, inner waters, inner estuary, fjord | Protected |
| Non-swell wave climate (Storm wave, Tropical cyclone influences, Sheltered area) | > 100 km | Stronger on-shore winds | Exposed |
| | | Weak on-shore winds | Moderately exposed |
| | 10 - 100 km | Stronger on-shore winds | Moderately exposed |
| | | Weak on-shore winds | Protected |
| | < 10 km | Any | Protected |

Source: Coastal Hazard Wheel

⁸ UNEP, 2016, Coastal Hazard Wheel Manual pp. 7

⁹ CHW uses the term 'Coastal morpho-dynamics' (i.e. the dynamics of beach morphology) refers to the study of the interaction and adjustment of the seafloor topography and fluid hydrodynamic processes, seafloor morphologies and sequences of change dynamics involving the motion of sediment (Coastal Hazard Wheel Manual).

Preliminary assessment

The alignment of City of Marion shoreline tends more to the north-east/ south-west in contrast to Onkaparinga and Adelaide metropolitan shoreline which tends to orientate north-south. Kangaroo Island provides significant protection from the Southern Ocean (Figure 6). The Marion Council region experiences strong on-shore winds from the north-west, west, and south-west. Winds from the north-west and west travel over the shallower waters of the Gulf and for distances less than 100kms. Using the CHW criteria in Table 1, Marion coastline is assessed in relation to wave exposure as:

| | Fetch length | Specific Coastal conditions | CHW classification |
|---------------------------------------|--------------------|---|--------------------|
| Swell wave climate | Any | The region does receive swell waves, but Kangaroo Island moderates the exposure | Moderate exposure |
| Non-swell wave climate (ie sea waves) | Moderately exposed | Fetch length in all directions apart from SW is less than 100kms. | Moderate exposure |

Drawing upon numerous sources, the Hallett Cove Coastal Management Study (HCCMS) has thoroughly evaluated the coastal processes in Gulf St Vincent as they impact upon the Marion coastline and should be relied upon in the final coastal adaptation plan (pp 17-26).

Swell waves are generated in the Southern Ocean, but after passing through Investigator Strait, and having ‘refracted, diffracted and attenuated due to bottom friction’, wave heights are much reduced as they approach the shoreline of Marion coastline. Swell waves that propagate to the Marion coastline region have 12-16 second periods, heights below 1m, and directions close to 260°. Sea waves within Gulf St Vincent are generally of short wave period and quite steep, frequently with white caps and approach the shore from the direction of the wind, mostly west-south-west winds, but can roll in at range 250° - 310°. Combine with south-west swells, the net wind-wave direction is northward. Wind waves are generally lower than swell waves but have been recorded at 2.6m in Gulf St Vincent¹⁰.

Figure 6: Geographical and meteorological features of Gulf St Vincent



Source: Map from location.sa.gov.au

¹⁰ See Lord, D (2012) Hallett Cove Coastal Management Study p 22

Storm surge components are not readily estimated as the different driving mechanisms may not occur in any single event and they are independent of wave conditions. Estimates of storm surge at particular locations are based on historical occurrence and calculated from tide height + storm surge height + wave effects (wave setup and wave runup). For design purposes, Coast Protection Board uses 1 in 100 average return interval methodology and has set sea-flood risk levels for the Marion Coastline region as detailed in Table 2:

Table 2: Coast Protection Board sea-flood risk level for Marion Council coastline.

| <i>Hallett Cove Beach/ Field River</i> | <i>AHD</i> |
|--|------------|
| Storm surge (1 in 100 ARI) | 2.3m |
| Wave setup | 0.4m |
| Wave run-up | 1.0m |
| Total risk height | 3.7m |

Source: Email James Guy, DEWNR, 13th October, 2017

Flinders Ports operate seven ports in South Australia, and provides further insight into the storm surge characteristics of the region¹¹:

‘...the most marked weather effects on the tide occur with the passage of a deep depression across the Southern Ocean. As the barometer starts falling and with the onset of northerly winds the tides are below prediction, but as the wind backs to the north-west, an increase in level occurs¹², with a gradual build-up if the wind remains steady. A strong gusty north-westerly wind, with such as depression, backing to the west south-west at about the time of low water, will cause a storm surge of maximum amplitude, and heights may be expected from 1m to 2m above prediction. These high levels will continue until the barometer starts to rise, and the wind backs rapidly to the south east within 12 hours, and with a rapidly rising barometer the tides return to normal (or below) in about that time’.

In the weather conditions described above by Flinders Ports, storms in the City of Marion region are accompanied by winds generally blowing onshore from the north-west, west, and south-west. More particularly, a north-west wind will tend to be directly onshore, while a south-west wind will tend to drive obliquely across the shoreline (Figure 6).

The highest recorded tide level at Outer Harbour occurred on 9th May, 2016 at 3.80m CD (2.35m AHD). Other key events in recent times are 4th July, 2007 and 25th April, 2009¹³.

Future assessment:

A coastal adaptation study should include:

A review of Council and community photographs and anecdotes to ascertain how significant storm events in Gulf St Vincent were experienced on the City of Marion shoreline. Combined with surveying and a Digital Elevation Model (DEM), the impact of significant events can be quantified, leading to a greater ability to forecast future impacts in association with sea level rise.

¹¹ Flinders Ports (ND) Port User Guide – General Information

¹² Lord 2012, adds that a north-west wind has the effect of banking water against KI which elevates water in the Gulf

¹³ Bureau of Meteorology, http://www.bom.gov.au/ntc/IDO59001/IDO59001_2016_SA_TP001.pdf

2.1.3 Tidal Range:

Synopsis¹⁴:

Tides can have significant impact on shoreline processes and on the development of coastal landforms. Tides are related to the moon's and sun's gravitational force acting on earth's water bodies and are 'present in the form of oceanic waves with wavelengths of thousands of kilometres, resulting in periodic fluctuations in coastal water levels'.

The tidal range controls the horizontal extent of the intertidal zone, the vertical distance over which coastal processes operate and the area being exposed and submerged during a tidal cycle (refer Figure 3). The effect of the tidal range on coastal morphology is largely controlled by the level of wave exposure. Therefore, the relative size of tides and waves of a location is more important than the magnitude of the tidal range itself. In other words, the impact on the coastline of a large tidal range is more benign without the associated impact of high wave exposure.

The tidal range is defined as the height difference between the high water and low water during a tidal cycle.

| <i>Tide type</i> | Tidal Range | Examples |
|--------------------|-------------|--|
| <i>Micro-tidal</i> | 0 – 2m | Southern seaboard of Australia |
| <i>Meso-tidal</i> | 2m – 4m | Malaysian and Indonesian coasts |
| <i>Macro-tidal</i> | Over 4m | NW European and NE North American coastlines |

Preliminary assessment

The effect of tides pushing up through a narrowing Gulf increases the tidal range in the northern parts of the Gulf. In the Marion region the categorisation is borderline in the upper ranges of micro-tidal but assessed as such by Lord 2012.

Climate change is not expected to alter the behaviour of the astronomical tide.

Table 3: Tidal range in Marion coastal region

| <i>Level</i> | Chart Datum (m) | AHD (m) |
|---------------------------------|-----------------|---------|
| <i>Lowest astronomical tide</i> | 0.00 | -1.45 |
| <i>Mean sea level</i> | 1.30 | -0.15 |
| <i>Australian Height Datum</i> | 1.45 | 0.00 |
| <i>Mean high water neaps</i> | 1.30 | -0.15 |
| <i>Mean high water springs</i> | 2.40 | 0.95 |

(Source required)

Future assessment

Future study should use DEM modelling to ascertain the impact of increased heights of astronomical tides on Marion coastal landforms over time. This assessment will assist in quantifying future impacts along cliff bases, and within the Field River and Hallett Cove Beach escarpments.

¹⁴ UNEP, 2016, Coastal Hazard Wheel Manual pp. 9

2.1.4 Sediment Balance:

Synopsis¹⁵:

The sediment balance is an essential geomorphic parameter and particularly important for coastlines falling into the sedimentary/soft rock categories. The sediment balance determines whether there is a net balance, deficit or surplus of sediment at a location over time and is largely determined by the sediment transport/availability and the relative sea level change. The sediment compartment in which the coastline of City of Marion is located is known as 'Adelaide Coast'¹⁶ (Figure 7).

Figure 7: Adelaide Coast sediment compartment



Source: Coastadapt.com.au/coastadapt-interactive-map

Preliminary assessment

Coastadapt's general assessment for the region is,

'The dominant regional processes influencing coastal geomorphology in this region are the Mediterranean to humid cool-temperate climate, micro tides, high energy south-westerly swells, westerly seas, carbonate sediments with interrupted swell-driven longshore transport, and the Southern Annular Mode (driving dominant south westerly swells and storms). Regional hazards or processes driving large scale rapid coastal changes include: mid-latitude cyclones (depressions), storm surges and shelf waves'¹⁷.

Overall sensitivity rating has been assigned within *Coastadapt* as 4 (with 1 being low sensitivity and 5 being high sensitivity). The southern section does have areas of resistant cliffed coast, but sediment supply to embayed beaches (such as Hallett Cove Beach) is predicted to decline.

¹⁵ Abridged synopsis from Coastal Hazard Wheel as sediment supply issues are well known in Gulf St Vincent.

¹⁶ See http://docs.coastadapt.com.au/sediment_compartments/SA02.01.04.pdf

¹⁷ See http://docs.coastadapt.com.au/sediment_compartments/SA02.01.04.pdf

Due to the proximity of Hallett Cove Beach to the Metropolitan Beaches to the north, the region has been the focus of numerous studies (See Lord 2012, pp 17-20). Drawing upon these sources, the Hallett Cove Coastal Management Study (HCCMS) has thoroughly evaluated the coastal processes in Gulf St Vincent as they impact upon the Marion coastline (pps 17-26) and should be relied upon in the final coastal adaptation plan.

The HCCMS summarises the sediment environment in Hallett Cove Beach region:

The foreshores of Hallett Cove present as a slowly receding coastline, starved of sediment.. The available coastal process modelling indicates the potential for sand transport out of the Hallett Beach compartment ($100,000\text{m}^3$ / year) is an order of magnitude greater than the natural rate of sand supply along the coastline from the south (5000m^3 / year)¹⁸.

HCCMS also acknowledges:

While the community perception that the sand cover has reduced over the past 30 years may be true, the likelihood is that over historical times the volume of sand on the beach has always been small and variable, providing a thin sand veneer from time to time over sections of the exposed shingle....[and that] ...additional sand cover is unlikely to be a practically achievable outcome (p.v)

Future assessment

The HCCMS did recommend ongoing monitoring of beach processes (see pps iv, 78,79,):

- Ongoing profile monitoring (in conjunction with CPB)
- Bathymetric modelling and monitoring
- Monitoring using photographic analysis

The purpose of these monitoring strategies is to maintain a perspective on the impact that coastal processes are having on the coastal environment over time.

2.1.5 Vegetation

Synopsis¹⁹

For some coastal environments, vegetation²⁰ constitutes an important parameter for their characteristics and hazard profile. In the Coastal Hazard Wheel system, vegetation is to be assessed where it is considered to play an important role for the coastal characteristics. The integration of the flora/fauna component in the classification system is complicated by its interdependence with other physical classification parameters and this is reflected in the application of the vegetational categories. In total, the classification system operates with nine different categories namely *intermittent marsh*; *intermittent mangrove*; *marsh/tidal flat*; *mangrove/tidal flat*; *marsh/mangrove*; *vegetated*; *not vegetated*; *coral* and *any*. The *vegetated* and *not vegetated* categories are applied to the geological layout category *sloping soft rock coast* where vegetation of the coastal slopes plays an important role for the coastline characteristics and determines whether it can be considered a coastal cliff. The *vegetated* category is applied when more than 25% of the initial coastal slope is

¹⁸ HCCMS suggests that this calculation is based on modelling at O'Sullivan's Beach Boatramp.

¹⁹ From: UNEP, 2016, Coastal Hazard Wheel Manual pp. 10,11

²⁰ CHZ uses the term 'flora/fauna' because it also incorporates a review of coral systems. In the context of this study the term 'vegetation' is utilised.

covered with vegetation while the *not vegetated* category is used when less than 25% of the initial slope is vegetated. Possible vegetation includes different grasses, scrubs and trees depending on the soft rock properties, slope and climatic conditions.

Although some types of vegetation have a better stabilizing effect than others, the important criteria from a coastal classification perspective is whether the coastal slope is vegetated or not.

Preliminary assessment

There has been no specific assessment in relation to the stabilising effect of vegetation on dunes and cliffs in the Marion region. Four studies have reviewed vegetation in the Hallett Cove region and may be useful resources for future assessment:

- Hallett Cove Coastal Management Study²¹ (2012)
- Hallett Cove Creeks Stormwater Management Plan (vegetation in the context of stormwater manage p. 59)²²
- Coastal Management Strategy (1997) (Appendices)²³
- Develop a coastal rehabilitation strategy. Lee Jeffery (2014)²⁴
- City of Marion Draft Remnant Native Vegetation Plan²⁵
- Metropolitan Adelaide and Northern Coastal Action Plan (MANCAP)²⁶
- Hallett Cove and Marino Conservation Parks Management Plan²⁷

Future assessment

In areas that become subject to coastal erosion, future studies on vegetation may be required to further understand their role in protection of coastal landforms, particularly in the dune areas of Hallett Cove Beach as identified by Lord (2012).

It is also noted that several areas of the Marion coast contain species and ecological communities of conservation significance (City of Marion 2017; DEH 2010; Caton et al. 2009). Beyond the scope of this study, further analysis of the threats to these communities and future adaptation pathways may be needed.

²¹ HCCMS did review vegetation but made no connection to coastal adaptation management.

²² Southfront (2012) Hallett Cove Creeks Stormwater Management Plan

²³ Kinhill Engineers (1997) Draft Coastal Management Strategy

²⁴ Jeffery L (2014) Develop a coastal rehabilitation strategy

²⁵ City of Marion (2017). *City of Marion Remnant Native Vegetation Plan*. Adelaide, South Australia

²⁶ Caton, B., Fotheringham, D., Krahnert, E., Pearson, J., Royal, M. and Sandercock, R. (2009). *Metropolitan Adelaide and Northern Coastal Action Plan*. Prepared for the Adelaide and Mount Lofty Ranges NRM Board and Department for Environment and Heritage

²⁷ Department for Environment and Heritage (DEH) (2010). *Hallett Cove and Marino Conservation Parks Management Plan*. Adopted by Minister for Environment and Conservation. Adelaide South Australia.

2.1.6 Stormwater flow paths to coast

Many storm water outlets drain directly to the sea from City of Marion rainfall catchment areas. Some outlets to the coast are open drains or creeks, while others begin as open drains but are connected to the coast by way of pipes. The main ones are identified on the maps below (Figures x-y). Note: The streamorder assignment recognises the number of tributaries that flow into the system. Streams with higher numbers may indicate large catchment systems.

In 2012, Southfront completed the Hallett Cove Creeks Stormwater Management Plan²⁸ and is referenced in this section where appropriate (See also Technical Context).

Section 1: Marino Cliffs

Figure 8: Stormwater flow paths in Section 1 (Marino Cliffs)



Source: location.sa.gov.au

Section 1: Marino (Cliffs)

| | Watercourse name | Location | Streamorder | Nature of outlet |
|-----|------------------|-----------------|-------------|------------------|
| 1:1 | Unclassified | Holdfast border | 2 | Pipe |
| 1:2 | Unclassified | Marino boatramp | 2 | Pipe |

²⁸ Southfront (2012) Hallett Cove Creeks Stormwater Management Plan

Section 2: Hallett Cove (Cliffs)

Figure 9: Stormwater flow paths in Section 2



Source: location.sa.gov.au

Section 2: Hallett Cove (Cliffs)

| | Watercourse name | Location | Streamorder | Nature of outlet |
|-----|------------------|--------------------------|-------------|------------------|
| 2:1 | Unclassified | Perry Barr Rd/ Westcliff | 3 | Open creek |
| 2:2 | Unclassified | The Esplanade | 2 | Open creek |
| 2:3 | Waterfall Creek | Conservation Park | 2 | Open creek |

The Waterfall Creek catchment area was defined by Southfront in the 2012 study in Figure 10.**Figure 10: Waterfall Creek Catchment area**



Source: Southfront (2012), p. 47

Section 3: Hallett Cove (Beach)

Figure 11: Stormwater flow paths in Section 3



Source: location.sa.gov.au

Section 3: Hallett Cove (Beach)

| | Watercourse name | Location | Streamorder | Nature of outlet |
|-----|------------------|--------------|-------------|------------------|
| 3:1 | Unclassified | Heron Street | 1 | Piped |

The Heron Way stormwater catchment area was defined by Southfront in the 2012 study (Figure 12)

Figure 12: Heron Way stormwater catchment area



Source: Southfront (2012), pp 48

Section 4: Field River Area

Field River was not part of the stormwater catchment area in the Southfront study (2012). The Field River largely forms the border between City of Marion and Onkaparinga Councils and most of the catchment area is within Onkaparinga Council.

Figure 13: Stormwater flow paths in Field River area



Source: location.sa.gov.au

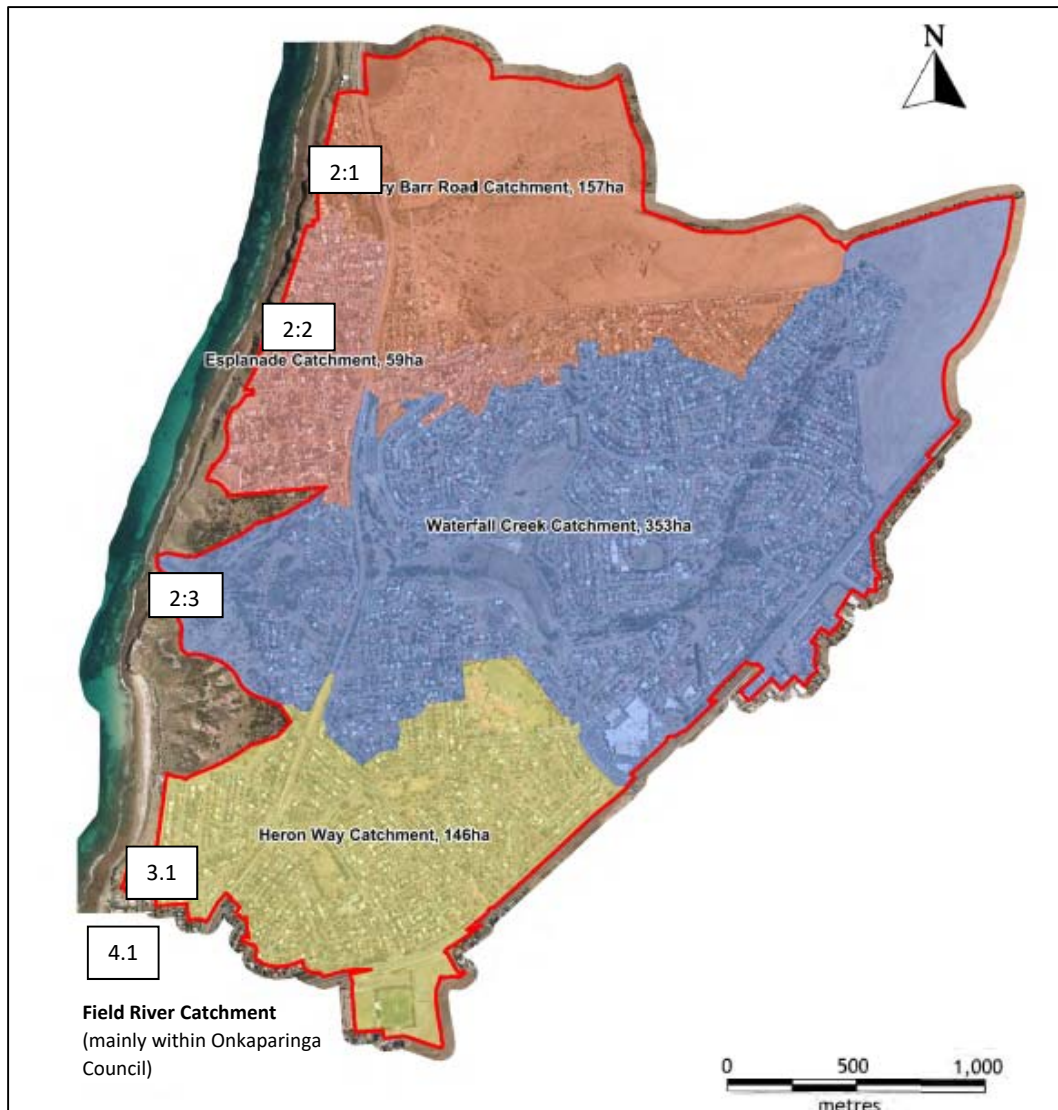
Section 4: Hallett Cove (Field River)

| | Watercourse name | Location | Streamorder | Nature of outlet |
|-----|------------------|--------------|-------------|------------------|
| 4:1 | Field River | River Parade | 4 | Open |

Section 5: Southern Cliffs

There is no publicly available information regarding the disposal of stormwater in relation to the coast for Section 5. A stormwater audit in the next section of work will quantify where storm water is discharged in this coastal region. Southfront depicted the various catchments in Section 2 (Hallett Cove: Cliffs) and Section 3 (Hallett Cove: Beach) in Figure 14. (Integrated Coasts has added outlet labels from above, and the location of the Field River catchment area).

Figure 14: Catchment areas in relation to coastal outlets



Source: Adapted from Southfront (p 3).

Assessment and further study

The ongoing impact of storm water systems upon the coastal zone should be taken into account for ongoing coastal management in the following ways:

1. Possible confluence of stormwater with sea-water inundation in a storm event and how this may increase erosion, damage, and danger to public safety,
2. Increase erosion of shorelines (and therefore make them less stable over time)
3. Impact on receiving environments including terrestrial and marine ecosystems.

2.1.8 Summary: Coastal Context

| Coastal Context | Summary |
|-------------------------|---|
| Geological | Marion Council is categorised predominantly as a combination of: Hard rock (R-1) and Soft Rock sloping shores (SR-10) The Field River Area is assigned as 'river mouth' (TSR) |
| Wave Exposure | Generally categorised as Moderate Exposure (CHW). HCCMS provides comprehensive review. |
| Tidal Range | Micro-tidal (bordering on meso-tidal), but does not have major bearing on sediment supply or storm characteristics. |
| Sediment Balance | Deficit (much less supply coming up the Gulf) than will proceed from the region. |
| Vegetation at shoreline | The impact of vegetation in relation to coastal change and adaptation has not been assessed. |
| Storm water management | Four main catchment areas in Sections 2-5. Some work has been done in containing storm water outflows, but an audit is required to ascertain what further work may be required. |

Preliminary assessment:

Coastal Hazard Wheel assessment designated the following general geological classifications and then assigned an inherent hazard rating based on the assignments in the table above. This does not necessarily infer that areas assigned low hazard ratings are free from vulnerability, and neither does the assignment of high hazard ratings infer that these are currently vulnerable. The assignment relates to an inherent hazard outlook relating to underlying geological layout and ocean processes.

The majority of the coastline falls into two main inherent hazard categories and associated assessment:

| Hard rock sloping shores Class- (R-1) | | | | | Soft rock sloping shores Class (SR-10) | | | | |
|--|-----|----------|------|-----------|---|-----|----------|------|-----------|
| | Low | Moderate | High | Very high | | Low | Moderate | High | Very high |
| Ecosystem disruption | X | 2 | 3 | 4 | Ecosystem disruption | X | 2 | 3 | 4 |
| Gradual inundation | X | 2 | 3 | 4 | Gradual inundation | X | 2 | 3 | 4 |
| Salt water intrusion | X | 2 | 3 | 4 | Salt water intrusion | X | 2 | 3 | 4 |
| Erosion | X | 2 | 3 | 4 | Erosion | 1 | X | 3 | 4 |
| Flooding | X | 2 | 3 | 4 | Flooding | X | 2 | 3 | 4 |

The Field River Area is assigned a higher inherent hazard rating.

| River Mouth Class (TSR) | | | | |
|----------------------------|-----|----------|------|-----------|
| | Low | Moderate | High | Very high |
| Ecosystem disruption | 1 | X | 3 | 4 |
| Gradual inundation | 1 | 2 | X | 4 |
| Salt water intrusion | 1 | 2 | X | 4 |
| Erosion | 1 | 2 | 3 | X |
| Flooding | 1 | 2 | 3 | X |

2.2 Climate Adaptation Context

Section two deals with the climate adaptation context in which Southern Adelaide is located.

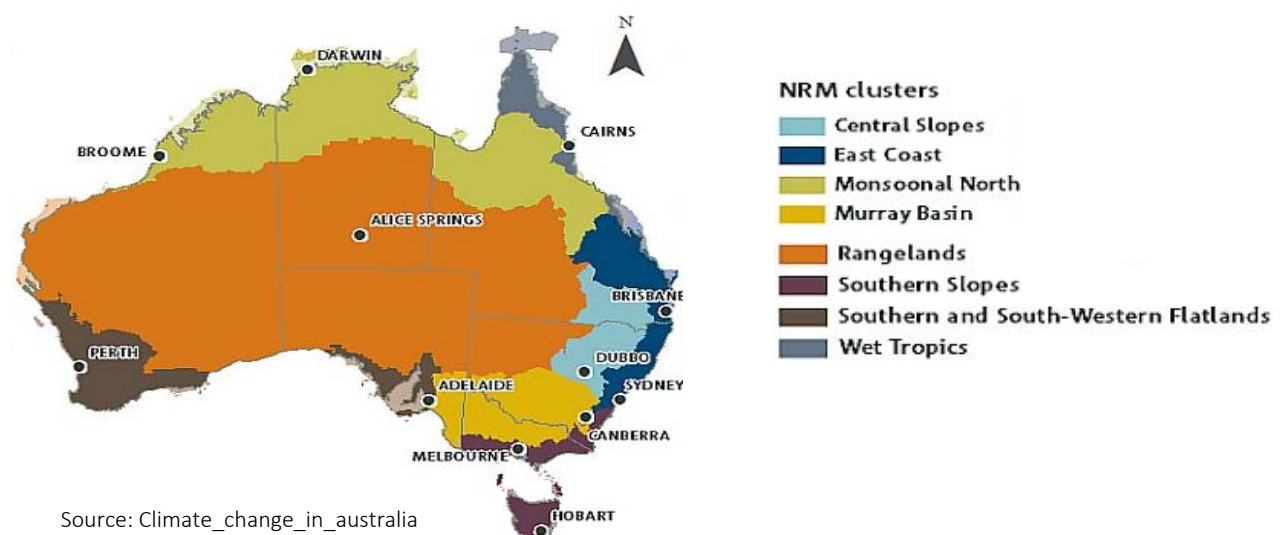
2.2.1 Climate Projections

General Circulation Models (GCMs) have been developed that are three-dimensional numerical models that take into account mass and energy transfer and radiant exchange and used to create projections that simulate the climate. The models are developed to mirror complex natural climate processes; while we are getting better at understanding some of these processes, there are still some things we cannot yet accurately explain, and this creates a measure of uncertainty. The models also need, as an input, information about our expectations of how greenhouse gas emissions will change in the future. This relies on predicting what direction government policies will take and the success of attempts to meet greenhouse gas emissions targets, again introducing considerable further uncertainty. Globally, projections are assembled through the Coupled Model Inter-comparison Projects (CMIPs) and evaluated by the Intergovernmental Panel on Climate Change (IPCC) in its assessment reports. The most recent models are called CMIP5. The CMIP5s are built on four future emission scenarios called the Representative Concentration Pathways (RCPs)²⁹.

In Australia, using the GCMs, projections have been produced at both national and regional scales by CSIRO and the Bureau of Meteorology (BoM) and by state governments or their agencies. Climate projections are spatially focussed around natural resource management regions (or clusters) for which information, data and reports are available. These regions are separated into four super clusters, eight clusters, and fifteen sub-clusters. Climate projections are given within the time frames of 2050 and 2090.

Southern Adelaide is located in the Southern and South-Western Flatlands Natural Resource Management Cluster³⁰.

Figure 15: Climate change modelling regions in Australia



Source: Climate_change_in_australia

²⁹ https://coastadapt.com.au/sites/default/files/information-manual/IM01_Building_the_Knowledge.pdf

³⁰ Climatechangeinaustralia.gov.au

The Australian Government *Climate Change in Australia*. program provides climate change projections which can be used to assist in planning climate change adaptation over time (see p 29). The designation of Southern Adelaide within the existing sub-cluster of Southern and South-Western Flatlands (East) is unlikely to change. Over time as more data is collected, these climate change models are likely to become more accurate, and the projections moderated accordingly.

Climate Change in Australia provides the following key messages for the sub-cluster in which Southern Adelaide is located³¹: **Table 4: Climate Projections for Southern and South-Western (Eastern sub-cluster)**

| Climate parameter | | Confidence |
|-------------------|--|----------------------|
| Temperature | Average temperatures will continue to increase in all seasons | Very high confidence |
| | More hot days and warm spells projected | Very high confidence |
| Rainfall | A continuation of the trend of decreasing winter rainfall projected | High confidence |
| | Spring rainfall decreases are projected | High confidence |
| | Changes in other seasons unclear, although downscaling results suggests a continuation of the observed autumn declines | Unclear |
| | Increased intensity of extreme rainfall events is projected | High confidence |
| Sea level rise | Mean sea level will continue to rise | Very high confidence |
| | The height of extreme sea-level events will increase | Very high confidence |

Contextual note from Climate Change in Australia: On annual and decadal basis, natural variability in the climate system can act to either mask or enhance any long-term human induced trend, particularly in the next 20 years.

Particularly in relation to extreme rainfall events

Climate Change in Australia states:

Increased intensity of extreme rainfall events is projected, with *high confidence*. Even though annual mean rainfall is projected to decrease in the region, understanding of the physical processes that cause extreme rainfall, coupled with modelled projections indicate with high confidence a future increase in the intensity of extreme rainfall events. However, the magnitude of the increases cannot be projected³².

³¹ <https://www.climatechangeinaustralia.gov.au/en/climate-projections/>

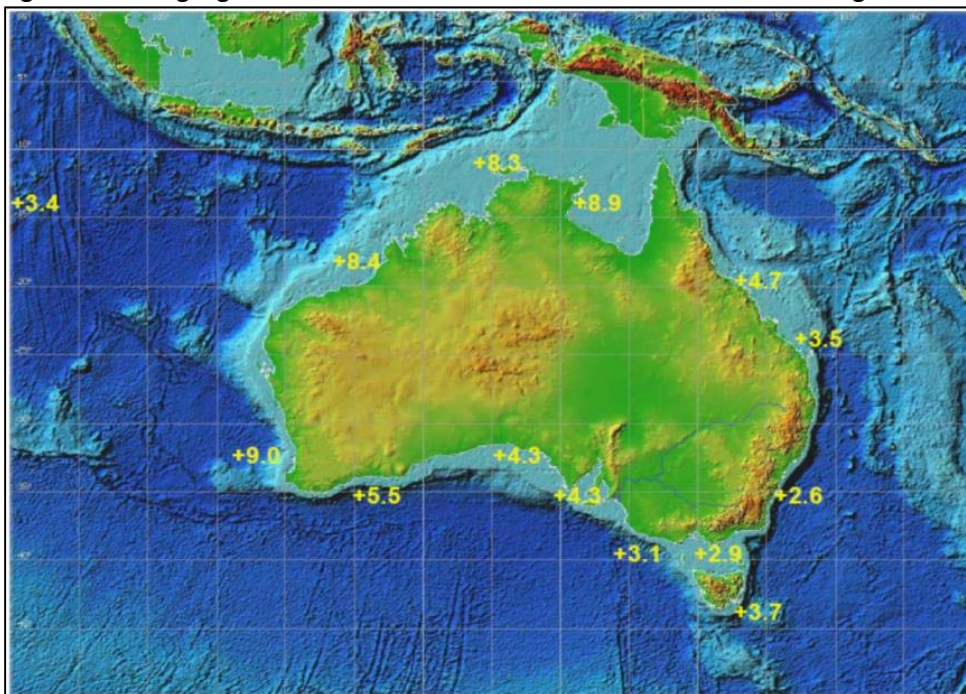
³² <https://www.climatechangeinaustralia.gov.au/en/climate-projections/>

Particularly in relation to sea level rise

Two tidal gauges at Port Stanvac (currently decommissioned), and at Thevernard west of Ceduna, as part of the national SEAFRAME project have been collecting tidal data since 1990. These gauges remove the 'noise' from the movement of the sea and the land and calculate changes to mean sea level over time. The data from both of these gauges provide clear evidence that sea level rise from 1990 to 2010 has been an average of 4.3mm per year (Figure 2:2). By comparison, longer term monitoring from the gauge at Pt. Adelaide which has over a hundred years of data, indicates that the rate of increase over the last century was an average of 1.5mm per year. This data indicates that sea levels in the region are rising and that the rate of rise has increased over the last thirty years.

If the current rate of sea level rise remained reasonably constant until 2050, a simple multiplication of 4.3mm x 60 years suggests an increase in mean sea level of 258mm which is comparable with the 300mm (0.3m) rise that SA Coast Protection Board has incorporated into its policy framework.

Figure 16: Tidal gauges at Thevernard and Pt Stanvac have recorded an average rise of 4.3mm³³



Source: Bureau of Meteorology

In the Field River region of Marion Council, Coast Protection Board has assigned the following sea-flood risk ratings:

| | Current | 2050 risk | 2100 risk |
|--------------------|----------|-----------|-----------|
| Storm surge | 2.3m AHD | 2.6m AHD | 3.3m AHD |
| Wave set-up | 0.4m | 0.4m | 0.4m |
| Wave run-up | 1.0m | 1.0m | 1.0m |
| Total Risk | 3.7m AHD | 4.0m AHD | 4.7m AHD |

³³ Bureau of Meteorology, 2013

Assessment Parameters

The purpose of the scoping study is to undertake a preliminary evaluation of the coastal zone in the context of coastal adaptation. Therefore, it is recommended that only a few coastal hazards be selected, and those that relate primarily to coastal adaptation. Three climate change hazards have been selected for this study:

- Increase in sea level (because a coastal adaptation study should include scenario assessment of sea level rise)
- Increased erosion (because erosion is already having an impact on Hallett Cove Beach. It is also possible that erosion is having an impact on the base of cliffs, but this is unknown)
- Increase rain intensity (because storm water outflows to the sea are already having an impact on cliff and dune erosion).

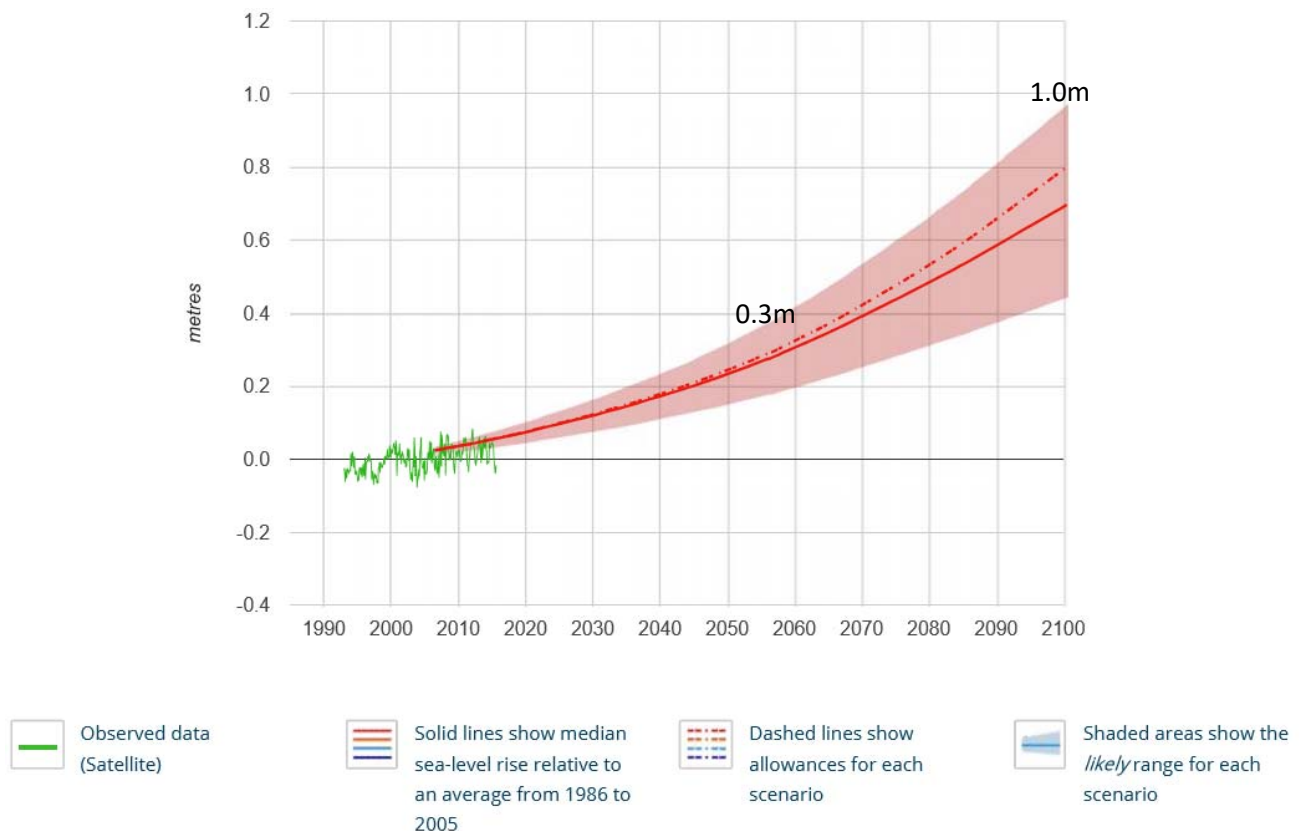
2.2.2 Emissions scenarios (RCPs):

The Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) in 2014 identified four emissions scenarios to frame projected climate futures. These are known as Representative Concentration Pathways (RCPs) and are framed by *CoastAdapt* in the following manner:

- RCP 8.5 Very high emissions pathway
- RCP 6.0 High emissions pathway
- RCP 4.5 Moderate emissions pathway
- RCP 2.6 Low emissions pathway

This scoping study has chosen RCP 8.5, very high emissions pathway, because the sea level rise projections are most congruent with Coast Protection Board's sea level rise planning benchmarks of 1.0m rise by 2100 as illustrated in Figure 15 adapted from CoastAdapt³⁴.

Figure 17: Projected sea level rise for RCP8.5 (with CPB policy levels)



Source: Adapted from Coastadapt (<https://coastadapt.com.au/sea-level-rise-information-all-australian-coastal-councils>)

³⁴ CoastAdapt, Shoreline Explorer, accessed August, 2017

2.2.3 Adaptation time frames:

South Australian Coast Protection Board since 1992 has incorporated sea level rise bench marks into statutory planning processes. Councils are required to assess any new development within 2050 and 2100 time-frames. The current sea level rise planning benchmarks are:

- 0.3m sea level rise (within indicative time frame of 2050)
- 1.0m sea level rise (within indicative time frame of 2100)

These time frames are also more congruent with the Climate Change in Australia time scenarios mentioned above at 2050 and 2090 into which climate change projections will be updated over time. It is therefore recommended that any future scenario planning and/or adaptation planning utilises the following time frames:

- Current risk
- 2050 risk
- 2090/ 2100 risk

2.2.4 Receiving environments

Coastal hazards have impacts on receiving environments that can be divided into primary and secondary categories. Examples of primary receiving environments are:

- Publicly owned infrastructure (roads, parks, foreshore assets, buildings)
- Privately owned infrastructure (normally land and buildings)
- Safety of people (for example, in a storm surge event)
- Coastal eco-systems (beaches, dunes, flora and fauna)

To provide an illustrative example of secondary receiving environments the following scenario could play out at any number of settlements around South Australia.

Primary impacts:

Increased erosion exacerbated by sea level rise and wave actions impact on the shoreline and long term decreasing sand supply to the beach, cause the beach of a settlement to go into decline over a period of years, exposing rock and soil beneath.

Secondary impacts:

Activities that were once held at the beach are no longer viable. This causes a sense of social loss. People do not feel as proud of their township as they once did. The loss of the beach may impact on tourism revenue as people choose to holiday or recreate in another location. Property prices may go into decline, and local businesses suffer stress.

Integrated Coasts recommends that the initial context of coastal adaptation study, focus should remain on primary receiving environments (which tend to be physical environments) rather than expending large amounts of resources determining the effect of coastal impacts in secondary receiving environments. For example, too much time expended into researching the social value of a beach settlement beach, without first quantifying the long-term outlook for the beach, may raise false expectations, and expend a significant amount of resources in the process. The matter here is one of order, not importance, because over time the impacts of coastal processes into secondary receiving environments (for example social) may be much more substantial. The process of

quantifying the impacts upon physical impacts first will tend to guide the community along a more realistic adaptation pathway, and then values can be more accurately gauged in that context.

In this study, the investigation into eco-systems will be contained to the consideration of how coastal change may impact an eco-system as a whole, rather than an analysis of the impact of coastal change on a particular species of flora or fauna. This approach is congruent with coastal assessment strategy of Coastal Hazard Wheel that assesses environmental matters in terms of larger scale 'ecosystem disruption'. Ecosystem disruption is more likely to occur in geological layouts such as mangrove tidal flats, river mouths or sand spit environments and is less likely to occur within a coastline which is dominated by cliffs.

Assessment Parameters

Coastal adaptation within the City of Marion will first focus on quantifying coastal impacts in the following categories:

- Public infrastructure
- Private infrastructure
- Public safety
- Ecosystem disruption

2.2.6 Summary: Adaptation Context

| Adaptation Context | Designation |
|--------------------------------------|--|
| NRM climate model sub-cluster | Southern and South-Western flat lands (West) |
| Regional adaptation planning | Southern Adelaide (Resilient South) |
| Adaptation time frames | 2050 and 2090/2100 (deemed the same) |
| Representative Concentration Pathway | RCP 8.5 High Emission Pathway |
| Hazards under consideration | Increased sea level (0.3m by 2050, and 1.0m by 2100), increased erosion, increase rain intensity (albeit slight) (See p. 33 for CPB sea-flood risk levels) |
| Receiving environments | Public infrastructure, private infrastructure, public safety, and eco-system disruption. |

Recommendations:

As part of an ongoing monitoring strategy City of Marion should monitor the Climate Change in Australia website and update projections as the models become more accurate. A commitment to using an evidence-based approach and the best available science is already made with the City of Marion Climate Change Policy.

2.3 Strategic Context:

Humans choose to reside, work and recreate in the coastal context. Governments are responsible to manage how humans operate in the context of the natural environment (land use planning and assessment), and are responsible for the safety and well-being of people. Reviewing the strategic context in which Marion Council operates will provide the context for the way in which adaptation is to be empowered over time.

2.3.1 National Legislation

There is currently no Australian legislation devoted to climate change adaptation. Rather, climate change has been considered in relation to broader environmental doctrines, such as environmentally sustainable development, and precautionary principle, often under planning and environmental legislation³⁵.

2.3.2 South Australian State strategic policy framework

Over time there has been a shift from individual Council's undertaking individual risk assessments to regional adaptation planning where Councils partner with regional stakeholders, such as Natural Resource Management Boards (NRMs) and Regional Development Australia Committees (RDA) to define and prioritise adaptation actions at a regional scale³⁶. In 2011 the South Australian Local Government Association (SALGA), in partnership with the Central Local Government Association, the Department of Environment, Water and Natural Resources, NRMs and RDAs developed the first climate change adaptation guidelines to support the development of Regional Adaptation Plans. The South Australian Climate Adaptation Framework adopted in 2012 committed all twelve state administrative regions to the development of a regional adaptation plan (by the end of 2016).

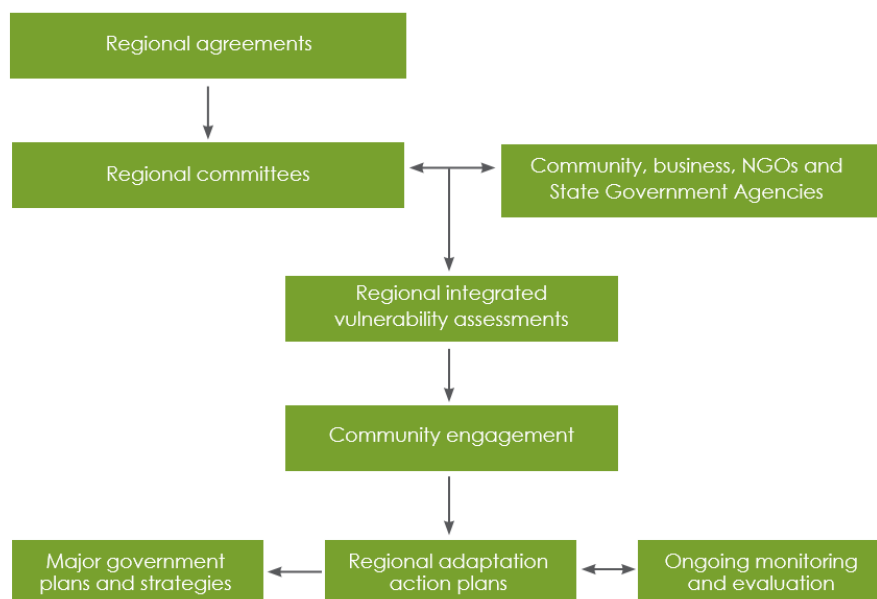
Specifically in relation to climate change adaptation, the *Climate Change and Greenhouse Emissions Reduction Act 2007* enabled voluntary regional agreements to be established in each of the State Government regions. These agreements are to define how partners (such as NRM Boards, Councils, key private sector organisations) will work together to plan and implement adaptation action. Signatories to the agreements may form 'regional steering committees'.

Over the last decade, State Government of SA has implemented a more regional approach to manage the State. The Natural Resources Management Act 2004 introduced eight natural resource management regions with independent management boards. Twelve administrative regions were also created and given impetus in the *30 Year Plan for Greater Adelaide (2010)*. Southern Adelaide Region encompasses Holdfast Shores, Mitcham, Marion and Onkaparinga Council areas. The Southern Adelaide Region is situated within the much larger Adelaide and Mt Lofty NRM region.

Specifically in relation to climate change adaptation, the *Climate Change and Greenhouse Emissions Reduction Act 2007* enabled voluntary regional agreements to be established in each of the State Government regions (Figure 17). These agreements are to define how partners (such as NRM Boards, Councils, key private sector organisations) will work together to plan and implement adaptation action. The Climate Change Adaptation Framework for South Australia (2012) advocated that climate change adaptation planning be conducted within these twelve administrative regions.

³⁵ CoastAdapt, Information Manual 6: A guide to legal decision making in the face of climate change

³⁶ South Australian Local Government Association – Climate Adaptation Planning Guidelines

Figure 18: Regional model for developing adaptation responses

Source: SALGA

Resilient South

The Southern Adelaide region (Holdfast Bay, Mitcham, Marion and Onkaparinga Councils) have cooperated together to produce the Resilient South Climate Change Adaptation Plan (2014).

In relation to coastal adaptation, the regional plan explains the general impacts of rising sea levels, changes to rainfall patterns, and increased erosion, but does not specifically review the coastal environs of City of Marion. The regional plan did identify some general options for coastal adaptation (see table below). In reference to Figure 4-3 below, the report did not identify any preferred coastal adaptation options for Marion.

Summary of preferred options for maintaining the Southern Region's natural features (e.g. cliffs, beaches, dunes, estuaries, biodiversity) and built infrastructure along the coast as our climate changes

Now

- Coordinated planning and monitoring;
- Inform and educate the community and encourage behaviour change;
- Review and amend Development Plan policy; and
- Develop soft structural options.

Within 20 to 30 years

- Construct hard structural options like storm tide barriers or sea walls.

Preparatory work

- It is recommended that a monitoring strategy be developed to inform decision making regarding the timing of construction of hard structural barriers.

Figure 4-3 identifies where these preferred options might apply spatially for the Southern Region.

Source: Resilient South

2.3.3 Local strategic context

Climate Change Policy (Summary)

Subsequent to the completing Resilient South Climate Change Adaptation Plan, Marion Council has adopted a climate change policy as a basis for managing climate change in the future.

The scope of the policy applies to all of Council's activities and services, and to Council's collaboration and communication with community to mitigate against climate change and to assist the community to build resilience and adapt to the impacts of a changing climate.

The context of the policy acknowledges that changes to Australia's climate are being accelerated by human activity which will bring about a range of changes to the climate. City of Marion recognises the importance of reducing the production of greenhouse gas emissions and adapt to climate change that cannot be avoided.

A summary of the key policy principles of the policy³⁷:

- Council will adopt an 'evidence based approach' using the best available science while recognising the need for flexibility to adapt as scientific knowledge improves,
- Mitigation and adaptation to climate change impacts will be undertaken particularly through land use planning powers, asset and infrastructure management, environmental planning, and natural resource management,
- Council will support its community...through education and encourage behaviour change that will increase community mitigation and adaptation efforts and to build resilience.
- Consideration of climate change and its potential impacts will be incorporated into Council's operations.
- Council will work regionally and at a State and federal level in partnership with others.

Council Strategic Planning (Summary)

Marion Council's strategic planning also explains how the Council intends to deal with climate change and associated adaptation over time³⁸.

The Council's community vision is, 'by 2040 our city will be deeply connected with nature to enhance people's lives, while minimising the impacts on the climate, and protecting the natural environment'.

The plan notes two key challenges: building capacity to adapt to climate change' and coping with the 'increasing impacts of climate change'.

10-year-strategies include: planning to respond to extreme weather events through services and urban form, managing infrastructure issues associated with flooding and stormwater, and to build community resilience to the impacts of climate change.

³⁷ City of Marion, Climate Change Policy

³⁸ City of Marion, Strategic Plan, 2017-2027

Council Business Plan 2016-2019

Council's business plan includes the items³⁹:

- Implement the Climate Change Policy and Plan (Resilient South Program)
- Develop and deliver a Regional Coastal Management Plan to support effective coastal management
- Manage storm water in close partnership with our neighbours

In summary, Marion Council has already achieved significant 'buy-in' from its executive officers to manage climate change adaptation over time.

2.3.4 Land-use planning and assessment

Marion Council assesses proposals for new development under the Development Act 1993 using policy set out in the City of Marion Development Plan.

The South Australian Coast Protection Board provides the state-wide policy for dealing with coastal matters and this policy finds its expression and application through local Development Plans. The Development Act 1993 and Development Regulations 2008 require Councils to refer new development in coastal zones to Coast Protection Board for 'regard' or 'direction'. A typical matter for 'regard' relates to the height above 0 AHD that a housing site or floor level is to be set. Matters for 'direction' include the implementation of coastal protection works. Coast Protection Board policy since 1991 has been to advise Councils to set floor levels 0.25m above the one in hundred ARI event and an additional 0.3m to allow for sea level rise by 2050. New development should also be able to demonstrate how it will cater for an additional 0.7m sea level rise by 2100.

The Council Development Plan (consolidated 28th April, 2016) is the statutory policy document to manage new development in the region. The Development Plan has been revised using the *Better Development Plan* process and therefore does contain the current Coast Protection Board policy. Specifically, in relation to Coastal Policy the only variation from *Better Development Plan* wording in the general and residential section is found in Coastal Areas (PDC 7)⁴⁰:

- 7 Unavoidable stormwater and effluent outfalls should be designed and located so as not to conflict with the objectives for coastal areas and if discharging across a beach do so at beach level from properly constructed pipes or channels.

Note: It is unknown if this has been achieved at Marion Council as yet. Strategic planning and the business plan identifies storm water management as a key focus.

³⁹ City of Marion, Business Plan, 2016-2019

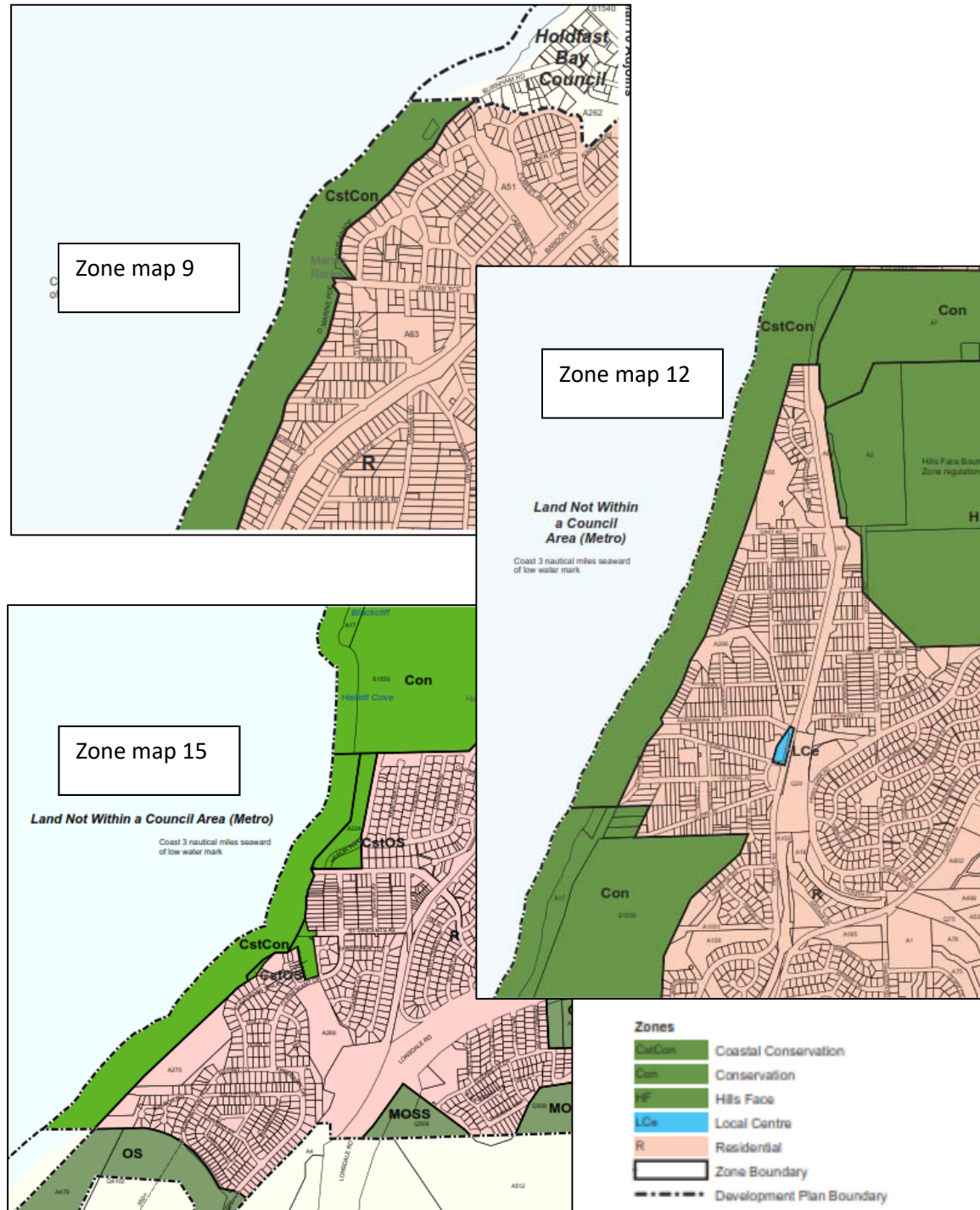
⁴⁰ Development Plan, City of Marion, consolidated 28th April, 2016

Prime land-use zones

The main land-use zonings applied to the City of Marion coastline are:

- Residential Zone
- Coastal Conservation Zone (for most of the shoreline)

Figure 19: Land-use zoning from Marion Development Plan



With this current zoning arrangement, there is probably no requirement for any development applications to be referred to Coast Protection Board for advice because all residential areas are separated from the ocean by a 'coastal conservation zone'. (Schedule 8, Development)

Secondary land-use policy areas

Land-use policy areas are limited to two: Hills Policy Area (11) and Coastal (21). All areas in proximity to the coast north of Grand Central at Hallett Cove Beach are zoned with Policy Area 11 (Hills) which is a low-density zoning suitable for hilly or undulating environments.

Hills Policy Area 11

Refer to the [Map Reference Tables](#) for a list of the maps that relate to this policy area.

OBJECTIVES

- 1 A policy area primarily comprising detached dwellings at low densities.
- 2 Residential development which is sensitive to the particular topography of the locality.
- 3 Residential development which has minimal visual and environmental impacts.
- 7 Dwellings should be designed to have a maximum site coverage of 35 per cent of the allotment area and a maximum floor area ratio of 0.4.
- 8 A dwelling should have a minimum site area, a frontage to a public road and an allotment depth not less than that shown in the following table:

| Dwelling Type | Site Gradient | Minimum Site Area (square metres) | Minimum Frontage Width (metres) | Minimum Site Depth (metres) |
|---------------|----------------------------|--------------------------------------|---------------------------------------|-----------------------------------|
| Detached | less than 1-in-10 | 700 | 18 | 20 |
| | between 1-in-10 and 1-in-5 | 900 | 20 | 20 |
| | more than 1-in-5 | 1100 | 20 | 20 |
| Group | less than 1-in-10 | 700 | 24 | 45 |
| | between 1-in-10 and 1-in-5 | 900 | 26 | 45 |
| | more than 1-in-5 | 1100 | 26 | 45 |

Coastal Policy Area 21 is confined to land south of Grand Central in the vicinity of the Field River. This policy area is also a low density environment that pays particular notice to floor and site level heights and requirements for coastal protection strategies (presumably by the proponents of the development).

Coastal Policy Area 21

Refer to the [Map Reference Tables](#) for a list of the maps that relate to this policy area.

OBJECTIVES

- 1 A policy area primarily comprising detached dwellings at low densities.
- 2 Residential development which is sensitive to the particular topography of the area and which has minimal visual and environmental impacts.
- 3 Residential development that mitigates the impacts of natural hazards such as sea level rise and flooding from the Field River through sensitive siting and design.
- 4 Development that contributes to the desired character of the policy area.

DESIRED CHARACTER

(portion only)

Land in the coastal policy area may be subject to coastal flooding and erosion and this risk will increase with sea level rise due to climate change. Protection strategies addressing the flooding and erosion risk are required. New development should be built to specific site and floor levels to minimise these risks.

PRINCIPLES OF DEVELOPMENT CONTROL

Land Use

- 1 The following forms of development are envisaged in the policy area:

- detached dwelling
- group dwelling.

Form and Character

- 2 Development should not be undertaken unless it is consistent with the desired character for the policy area.
- 3 Development including roads and parking areas should be protected from sea flooding by ensuring all of the following apply:
 - (a) site levels are at least 4 metres Australian Height Datum
 - (b) building floor levels are at least 4.25 metres Australian Height Datum
 - (c) there are practical measures which can be undertaken on-site to protect the development against an additional sea level rise of 0.7 metres, plus an allowance to accommodate land subsidence until the year 2100.
- 4 Development should avoid or mitigate the potential impacts of sea level rise and flooding adjacent the mouth of the Field River through intelligent siting and design based on sound coastal management practices.
- 5 Dwellings should be designed to have a maximum site coverage of 35 per cent of the allotment area and a maximum floor area ratio of 0.4.
- 6 A dwelling should have a minimum site area and a frontage to a public road and site depth not less than that shown in the following table:

| Dwelling Type | Minimum Site Area other than for affordable housing (square metres) | Minimum Frontage Width (metres) | Minimum Site Depth (metres) |
|---------------|---|---------------------------------|-----------------------------|
| Detached | 700 | 18 | 30 |
| Group | 700 | 24 | 45 |

Strategic context - Summary

Resilient South

In relation to Coastal Adaptation Planning:

- Resilient South doesn't provide an adaptation context for Marion Council apart from broad coastal adaptation themes/ guidelines.
- In particular, recommendation that within 20-30 years to 'construct hard structural options like storm tide barriers or sea walls' should be disregarded
- There is a general recommendation to 'amend development plan policy' but no further context.

Statutory Planning (Development Plan Amendment):

- As a result of a State wide planning review that is currently underway it would be unwise for Council to spend resources in Development Plan review or amendments until the new Development Act and Regulations and new Development Plans have been implemented. However, these coastal adaptation studies will provide the basis of the 'investigations' required to undertake a Development Plan Amendment.
- Council is contemplating reviewing urban densities within its region. Some early form of connection with this coastal adaptation process is recommended. A preferable approach is to complete this coastal adaptation plan, which could then inform any strategic review of land use in the coastal region.

Strategic planning

Marion Council has achieved ample 'buy in' for coastal adaptation (and climate change adaptation in general) at a local and regional level with the adoption of the Climate Change Policy, and the implementation measures included in the Strategic Plan (2017-2027) and current Business Plan (2016-2019). Specifically, strategic planning recommends to:

- Mainstream climate change matters into Council operations
- Implement the Climate Change Policy and Plan (Resilient South Program)
- Develop and deliver a Regional Coastal Management Plan to support effective coastal management
- Manage storm water in close partnership with neighbours.

2.4 Historical context:

A history of each settlement provides an important cultural context to the study and may also improve understanding of any initial assessments that were undertaken in relation to potential impacts of the sea. In relation to Council liability, when a settlement was founded, and whether it has undergone any substantial expansion are key issues to be assessed. In particular in relation to coastal matters, any previous coastal studies that have been undertaken are identified and assessed.

Key assessment questions:

- When was the settlement established?
- Has the settlement been expanded, and if so what were the historical circumstances?
- What account was taken in relation to potential impacts from the sea in the establishment or expansion of the settlement?
- Have any coastal incidents occurred such as inundation or erosion?
- What previous coastal studies have been undertaken?
- Are any coastal management plans in place?

2.4.1 When were coastal settlements established?

Section 1 – Marino: Cliffs

Marino was subdivided for residential occupation in 1912 (at the same time as Woodlands Park, Morphetville, Hallett Cove Model Estate)⁴¹. The research conducted into the cliff collapse at Hallett Cove (Section 2 – Cliffs) in 1996 concluded that the initial subdivision was likely to have been completed in England with an esplanade road designed impractically over deep gullies⁴².

Section 2 – Hallett Cove: Cliffs

Hallett Cove (cliff section) in the north of the suburb of Hallett Cove was likely to have been subdivided at the same time as Marino. The Perry Barr area subdivision was completed in 1974. In 1976, the Hallett Cove Conservation Park was established⁴³. The Hallett Cove Study Report in 1977 recommended that some of the vacant land be purchased from Hallett Cove Development Company to further consolidate and unify the conservation park⁴⁴.

Section 3 – Hallett Cove: Beach

The same research in 1996 mentioned at Section 1 above, also noted that houses were likely to have been constructed in Hallett Cove in late 1970s to 1980s. Several resources note the struggle between developers and conservations over the period of 1962 to 1974⁴⁵. A likely impetus for the struggle may have had its genesis in State planning in the early 1960s that advocated Hallett Cove region for urban expansion⁴⁶.

⁴¹ Dolling, A (1981) Marion on Sturt

⁴² Fotheringham, D (1996) Communication to Minister for Environment and Natural Resources regarding potential collapse of cliff at The Esplanade.

⁴³ Dolling, A (1981) Marion on Sturt

⁴⁴ Cullen et al (1977) Hallett Cove Study Report

⁴⁵ Dolling, A (1981) Marion on Sturt

⁴⁶ Jeffery, L (2012)...but no historical source was included in this study.

2.4.2 What were the historical circumstances of any expansion (s)?

A preliminary search of Coast Protection Board (DEWNR) hardcopy archives, and report received via email from DEWNR revealed no significant expansions of settlements in coastal areas subsequent to 1990 apart from areas south of Field River. In 1992 six allotments were subdivided into 109 allotments (D109/92) and a further subdivision of 1 allotment into 14 allotments occurred in 1993 in an area closer the Field River (D060/93). A Development Plan Amendment has been completed for the residential area around Field River and a Coastal Policy Area 21 designated over the area.

2.4.3 Was there any requirement to assess potential impacts from the sea in the establishment or expansion of the settlement?

The subdivisions of Marino and Hallett Cove (North) were subdivided a very long time ago, and possibly executed in England.

Preliminary historical research indicates that subdivision and establishment of Hallett Cove suburb, and perhaps the construction of houses at Hallett Cove (North) was completed circa 1974 to early 1980s. These are likely to have been approved under the SA Planning and Development Act 1967. There was no requirement to assess any actions of the sea within this Act. The Coast Protection Board came into being in 1972, and one of its first actions in 1974 was to decline to approve the proposed marina for Hallett Cove. There is no record of any protest from Coast Protection Board in relation to the establishment of Hallett Cove generally.

Both subdivisions in the Field River (1992, 1993) area were referred to the Coastal Management Branch who stated no objections to the subdivisions. However, both referrals gave advice that the Coastal Management Branch was not opposed to the development from a coastal engineering viewpoint provided impacts on the adjoining cliff were minimised stating, 'without control of the disposal of stormwater from the site and increased pedestrian activity in the area the stability of the naturally erodible cliff area is at risk'. The Coastal Management Branch also recommended that to minimise the hazard... 'an engineering and geological study of the cliff area be undertaken to allow council to assess the suitability and design of the drainage system'⁴⁷.

This study has not evaluated whether any engineering and geological study' has been completed.

Both applications were referred and assessed under powers of the Planning Act 1982 and prior to the Development Act 1993 coming into effect. Considerations of impacts of the sea were first introduced into statutory planning documents in 1994.

Implications for Marion Council

It is unlikely that any residual liability exists in the founding or expansion of the settlements within Marion coastline. Most expansions were conducted well prior to 1990s (where coastal processes and climate change began to be taken into account in Development Plans). The expansion of Field River was conducted in the early 1990s, but was referred to Coast Protection for comment (under 1980 Planning Act).

2.4.4 What Development Applications have been referred to Coast Protection Branch?

⁴⁷ Coast Management Branch (now within DEWNR) 1993-1994, DA100.060.93 and DA100.026.94

Example 1

One example exists where Coast Protection Branch recommended against approval unless certain conditions were met. A proposal for a shop and residence at Marino (DA100/1791/97) was met with the following response from Coast Protection Branch:

The coastline adjacent to this proposed development may be at risk by coastal storm flooding and erosion, and this risk will increase in the event of future sea level rise due to global warming. Accordingly, the Board recommends against approval unless Council is able to ensure that an adequate flood and erosion protection strategy is in place to protect the development, to make it comply with the 'Hazard Risk Minimisation' principles contained within the Council section of the Development Plan...

Erosion

The coastline at this location has been subject to slow coastal erosion and the proposed development is less than 50 metres from the top of the cliff edge. However, it is considered to provide sufficient protection to satisfy Council's current erosion criteria.

The Board has no objections to this development providing... (3) Council accepts responsibility for future protection of Marine Parade and the existing carpark if it becomes necessary⁴⁸.

The Board attaches the following disclaimer to the above advice;

Based upon current knowledge and information the development and development site is at some risk of coastal erosion due to extreme tides notwithstanding any recommendations or advice herein, or may be at future risk. Neither erosion nor the effect of sea level change on this can be predicted with certainty. Also, mean sea level may rise by more than the 0.3 metres assumed in assessing this application.

Accordingly neither the South Australian Coast Protection Board nor any of its servants, agents or officers accept any responsibility for any loss of life and property that may occur as a result of such circumstances.

This marks the first time that CPB advice is given in the context of climate change and associated sea level rise. CPB has also shifted responsibility to the Council for any future protection of Marine Parade (but on what basis, is unknown).

Example 2:

Several examples exist of advice from Coast Protection Board given to Council in relation to storm water management and cliff stability. This advice become prevalent after the 1996 cliff collapse at The Esplanade, Hallett Cove.

Example: DA 100/2253/01 Land Division includes the advice that:

The Council is advised to seek a geotechnical report on the stability of the cliff in the vicinity of this land to ensure the suitability of the land for future development. Any runoff of stormwater from the proposed allotments should be considered in the design of future development proposals with a view to limiting the potential for impact on the cliff.

2.4.5 Have any incidents of inundation or erosion occurred in the coastal zone?

Inundation

⁴⁸ Coastal Management Branch (now within DEWNR) response to DA100/1791/97.

No record exists in the files at Coast Protection Branch (DEWNR) in relation to any inundation of any of Marion coastline and the Hallett Cove Coastal Management Study makes no findings in relation to inundation events. Anecdotes exist among staff about the impact of 9th May, 2016 and in October 2016 at Hallett Cove Beach.

Erosion

The Hallett Cove Coastal Management Study gave significant review of erosion patterns study sections 3-4, and especially in relation to sand supply and erosion at Hallett Cove Beach (p, 15,30).

Two Development Applications were lodged by Council to CPB to deal with erosion issues:

Development Application (DA100/0552/98):

In 1998, a Development Application by Council for a rip rap sea wall to the south of Field River was referred to Coast Protection Board who responded:

While it is appreciated that the coastline at this location is subject to slow coastal erosion, it is not currently threatening development and the Branch would appreciate justification for undertaking the work at this time. A considerable portion of the State's coastline is subject to erosion and the Board does not support the placement of rock protection on the coast without having due consideration to its impact on the beach and sand supply.

Development Application (DA100/0932/99)

An application was received by Coast Protection Branch in 1999 to place rock protection on the Hallett Cove Beach (DA 100/0932/99). However, this request was declined, among other reasons, because:

An assessment of aerial photograph has indicated that the area has remained relatively stable for the past five years and the Board does not consider there is a need for heavy protection measures at this time. While it is appreciated that the exposed trolleys may represent some risk and appear unsightly burying them with the onsite sand and shingles is considered a more preferred option.

These responses seem to suggest a stable beach environment.

Cliff Collapse – The Esplanade, Hallett Cove

In October, 1996, a section of cliff collapsed at the Esplanade, Hallett Cove. Investigations concluded that the collapse was caused by a combination of the natural geology combined with an unusually wet winter. CPB concurred that the land slide was not as result of any coastal processes, and also refused any funding for rectification works (on that basis). A review of all the reports suggests that both the Council and the State Government received legal advice that neither were liable for the landslide. However, Council did raise funds to further collapse the cliff and stabilise the situation. The purpose of this study is not to investigate this incident, but rather to highlight that this case provides a crucial insight into liability issues relating to development in the vicinity of cliff tops should erosion begin to be felt at the base of the cliffs due to increased sea levels and wave action.

4.6 Summary: Historical context

| | |
|---|---|
| When were coastal settlements established? | Section 1 -2: were initially established circa 1912, with the subdivision most likely completed in England Section 3: HC Beach established in 1974 to early 1980s. Section 4: Field River was established in 1992, 1993. Section 5 : Southern Cliffs (later?) |
| What are the circumstances of any expansions? | Section 4: Hallett Cove (Field River) should be regarded as expansions (1992, 1993). |
| Did any obligation exist for Council to assess actions of the sea when establishing settlements? | No legal obligation existed for Council to consider action of the sea in founding Sections 1-3. Coast Protection Board was in existence when Section 3 (Hallett Cove Beach) was established, and despite opposing the proposed marina, made no objection to the establishment of Section 3 (Hallett Cove Beach). |
| Did any obligation exist for Council to assess actions of the sea when expanding settlements? | Yes, Council was required to consider actions of the sea in founding Section 4 Field River area. Two subdivisions were referred to CPB for 'regard' and no objections were raised to either. However, CPB did mention matters relating to cliff stability. Section 5 was not referred. |
| What Development Applications have been referred to CPB? | Council made two applications for protection works for 'direction'. A rip rap wall for dune at Field River (declined), and rock walling for Hallett Cove Beach (more information requested). Private development applications were also referred. One was recommended for refusal unless certain conditions were met. No objections were raised to the remainder, but CPB recommend Council obtain geotechnical advice in relation to cliff stability, or in relation to storm water run-off impacting cliff stability. |
| Have any inundation events occurred? | No infrastructure or housing has been impacted by inundation. The storm even of 9 th May 2016 did impact the shoreline (no photographs reviewed as yet). |
| Have any erosion taken place? | Erosion has occurred at various places along the beach as described in HCCMS. |
| Any other events? | The cliff collapse/ land slide of 1996 at The Esplanade (Section 2) provides a very useful case study into matters of liability. Both the Council and the State appeared to have received advice that they were not liable for this land slide. |

Future research:

Did Council undertake any geotechnical analysis on the stability of the cliff (s)

A comparative review of historical photographs (especially of cliff areas) would enhance the erosion picture.

A larger study should review the 1996 cliff collapse file would provide a 'window' into Council liability in relation to cliff top settlements. Such a review may be useful in the light of any recommendations that urban density be increased in these areas.

2.5 Technical context (studies and plans):

2.5.1 Hallett Cove Study Report (1977)

The main focus of this study is the conservation park, public access issues, and the possible purchase of further land to consolidate the park. However, one reference does give an insight into the nature of the beach at that time, and reports on a comparative examination of aerial photographs taken in 1949 which 'show there have been no substantial changes to the beach over this period'⁴⁹.

2.5.2 Photographic Report (1993)

A photographic report was conducted by Colin Mayberry and Shaun Matschoss as part of their final year research project for University of Adelaide, Department of Civil and Environmental Engineering. The project, *Foreshore Erosion at Hallett Cove*, contains dozens of photographs from the time, as well as including historical photographs, which provide a window into the nature of the beach over time. Focus was given to the perceived role of the breakwater at Port Stanvac and the build-up of sand on the south side, with the inference that supply of sand was inhibited to Hallett Cove Beach⁵⁰.

A larger coastal adaptation study may wish to review this file (File at DEWNR).

2.5.3 Beach Profiles (1975 to 2010)

Coast Protection Branch (in its various forms, currently DEWNR), has been taking beach profiles at two locations on Hallett Cove Beach. Seven beach profiles have been taken in the period 1975 to 2010. However, these profiles are not accompanied by any interpretation as to what they might indicate is occurring at Hallett Cove Beach over time, but they were analysed by the Hallett Cove Management Plan (2012)⁵¹.

Figure 20: Beach profiles by DEWNR



2.5.4 Coastal Management Strategy Plan (26 July, 1997)

⁴⁹ P.W.Cullen et al (1977) Hallett Cove Study Report, p. 61

⁵⁰ Matschoss S, Mayberry, C (1993) Foreshore erosion at Hallett Cove (Research project, Uni of Adelaide)

⁵¹ Accessed in DEWNR archives, Marion Council, August, 2017

This report prepared by Kinhill Engineers provides insight into issues under consideration at the time, including storm water run-off over cliffs, dune erosion, cliff stability issues. One of the main issues under consideration was forming of coastal walkway. The report also provides a full inventory of coastal features including storm water outlets, and coastal protection measures.

The quote below from the introduction of the report contextualises the main issues under consideration,

‘the coastal management strategy for Marion seeks to promote improvements in the management of the coastal strip by developing a coastal management plan which identifies appropriate uses and adjoining buffer areas, access paths, traffic management, car parking, the location of visitor facilities and tourist opportunities’.

IN particular, and of relevance to this study the report recommends:

- Develop opportunities for stormwater management improvements
- Augment existing initiatives to protect sand dune areas where necessary to ensure the retention of dunes
- Develop a revegetation programme for the coastal areas⁵²

2.5.5 Coastal Management Study – Hallett Cove (2012) by Doug Lord

The Coastal Management Study (2012) is a comprehensive review of coastal processes of the Hallett Cove Beach region (Section 3 of this study) that brings together all the strands of previous coastal history and adaptation work and should be utilised as a foundation document for any coastal adaptation planning for Hallett Cove Beach.

The stated aim of the study ‘was to assess current and potential future coastal management issues at Hallett Cove and to identify and evaluate alternative management strategies in response to those issues that could be considered in a coastal management plan for the area’.

The purpose of the coastal management plan was to inform the redevelopment of Heron Reserve (that reserve is now planned and out for consultation).

Research Questions:

Has the Heron Reserve proposal been approved/ reviewed by DEWNR in relation to coastal processes and climate change? (2050, 2100?) The answer is ‘yes’ it has been approved.

Did the Heron Reserve proposal take into account the HCCMS recommendation to decrease the slope of the escarpment between the reserve and the beach? (this may be imperative over time)

2.5.6 Hallett Cove Creeks Stormwater Management Plan (2012)

⁵² Kinhill Engineers (1997) Draft Coastal Management Strategy Plan

The Hallett Cove Creeks Stormwater Management Plan (2012) produced by Southfront is a thorough investigation of the current storm water system for three catchment areas located in Section 2 and 3, and a suggested improved management strategy.

The report concluded that stormwater infrastructure was assessed as meeting performance standards in line with current day expectations (with a few exceptions). The study used a 1 in 10 ARI rainfall event which it considers the standard event to use in evaluating the effectiveness of stormwater infrastructure capacity. Coincidentally, such an event did occur within the study period and the effectiveness of the system was evaluated in that context.

The key issues flagged for improvement were:

- Erosion of Waterfall Creek channel, along most of its length (MW has reviewed the outlet to the sea only)
- Lack of stormwater quality improvement measures
- Lack of stormwater harvesting and reuse

The report lists numerous recommended upgrades and strategies, but none of these appear to relate to ocean outfalls (apart for GPT at Heron Reserve). However, the study did review coastal outlets (see below)⁵³.

4.3 Coastal Outlets

While the significant majority of the Study Area is drained to watercourses or gullies that ultimately discharge into the Gulf, there are a number of the underground stormwater drainage systems that also discharge directly to the Gulf.

There has previously been concern regarding the erosion of cliffs and beaches due to many of these outfalls discharging well above beach level, with little or no erosion control or pollutant interception measures in place. A review of these outfalls (AWE, 2005) developed concept designs to address the issues identified.

There are 6 outfalls within the study area that were reviewed. The status of the concepts proposed within AWE (2005) are summarised in Table 4.3 below.

Table 4.3 Coastal Outlet Works

| Location | AWE Ref | AWE Recommendation | Status |
|-------------------|---------|-----------------------------------|-------------------------------|
| Westcliff Ct | 11 | No work required | - |
| Nungamoora St | 13 | Install GPT | Outstanding |
| Peera St | 14 | No work required | - |
| Fryer Street | 16 | Install GPT | Outstanding |
| Clifftop Cr | 18 | Install rock-lined overflow swale | Completed (refer photo below) |
| Grand Central Ave | 21 | Install GPT | Outstanding |

Source: Hallett Cove Stormwater Management Plan (p. 43)

⁵³ Southfront (2012) Hallett Cove Creeks Stormwater Management Plan

A digital terrain model was acquired for the study in 2008 and achieved a vertical accuracy of 0.15 RMS on open clear flat surfaces and contours created at 1m intervals.

The report did note that climate change leads to changes in frequency, intensity, duration of rainfall patterns. However, because the time frame of the study was limited to 2050, no account was taken of increased rain intensity in the study (and this is congruent to climate change projections).

2.5.7 Develop a coastal rehabilitation strategy, Lee Jeffery (2014)

This report was submitted as assessment item for Diploma of Conservation and Land Management at TAFE. All matters to do with coastal processes and adaptation are taken from the Hallett Cove Coastal Management Study. However, the report does provide significant review of flora and fauna in the Hallett Cove region⁵⁴.

2.5.8 Developing a management strategy for coastal cliff erosion hazards in SA (2014)

This report was produced by Coast Protection Board in response to several cliff collapses around the State. It provides a resource from which to undertake preliminary evaluation of the cliff environment in Marion Council. The report notes that CPB have recently undertaken a hazard assessment of coastal cliff landforms along the South Australian coast which flags potential hazard areas for priority management according to how susceptible they are to erosion⁵⁵.

2.5.9 Summary: Technical Context (Studies and Plans)

Research Questions

Has any account of sea level rise been undertaken with any DEM modelling? (the Hallett Cove Creeks Stormwater Management Plan did utilise a DEM for its study...see below)

Have storm water outlets to the ocean all been upgraded (in accordance with Figure 4.3). What works are outstanding? What outlets may still be causing erosion within cliff gullies?

Should long range storm water planning begin to consider how the storm water systems would cope to year 2100 (and beyond?) 2050 is only 20 years away, and infrastructure that is installed now is expected to have much longer life spans than this.

Would works and strategies mentioned above be effective in catering for larger rain events (or could some of them be expanded to cater for larger events in the future)?

Research question: Has been done on Field River catchment (the main section of Field River catchment is within Onkaparinga)?

Where is the CPB cliff study?

⁵⁴ Jeffrey, L (2014) Develop a coastal rehabilitation strategy

⁵⁵ Coast Protection Board (2014) Developing a management strategy for coastal cliff erosion hazards in SA

Has the Heron Reserve proposal been approved/ reviewed by DEWNR in relation to coastal processes and climate change? (2050, 2100?) (The answer is 'yes' it has been approved).

Did the Heron Reserve proposal take into account the HCCMS recommendation to decrease the slope of the escarpment between the reserve and the beach? (this may be imperative over time)

| Studies and Plans | Scope | Relevance/ Focus |
|---|--|--|
| Hallett Cove Study Report 1977 | Section 2 Hallett Cove (cliffs) and Section 3 Hallett Cove (beach) | The main focus relates to the establishment of the conservation park. One note about Hallett Cove Beach with comparison of photographs to 1949. |
| Photographic report 1993 | Section 3 Hallett Cove (beach) and Section 4 Field River (and south) | Useful set of photographs providing a window into beach at 1993, but also contains older photographs. |
| Beach Profiles 1977 to 2010 | Section 3 Hallett Cove (beach) | Seven beach profiles at two locations provides data to analyse bathymetry of the beach over 35 years. |
| Draft Coastal Management Plan 1997 | All sections | Main focus on managing public access and controls over coastal areas (Including the proposed walking trail). Very useful review of flora and fauna, existing coastal structures. Less useful in relation to coastal processes (and superseded by 2012 study (see below) However, does provide window into the time period. |
| Coastal Management Study – Hallett Cove Beach 2012 | Section 3 Hallett Cove (beach) but also includes Field River (Section 4) | An exceptionally thorough report that reviews and details coastal processes, erosion history. The purpose of the report was to underpin proposed upgrade /development of Heron Reserve. This report should form the main basis for any coastal adaptation work for Hallett Cove Beach. |
| Hallett Cove Creeks Stormwater Management Plan 2012 | Section 2 Hallett Cove (cliffs), Section 3 Hallett Cove (beach) | An effective review of the storm water system for three catchments. Main focus is the efficiency of the system (climate change is discussed in relation to 2050 only). Provides insight into locations of storm water outfall (to the ocean) and any associated works (including those still pending). Provides analysis of nature of outfall (pollutants etc) A DEM was obtained for the study. |
| Develop a coastal rehabilitation strategy 2014 | Section 3 Hallett Cove (beach) | A student report, but very thorough, and provides insight into ecosystem. |
| Development a management strategy for cliff erosion hazards (2014) | General report (produced by CPB for State) | A review of coastal processes that cause cliff failure. |

3. Coastal Tour

At this point of the project, a thematic review of the entire Marion coastline within the following categories has been concluded. The purpose of undertaking the contextual review is to 'draw a line in the sand' at today's date and declare, 'this is what we know'.

- Coastal context
- Adaptation context
- Strategic context
- Historical context
- Technical context (studies)

In conceptual terms, the study so far has been a thematic review across the entire coastline of Marion. The coastal tour is the point of the project where attention is focussed vertically at particular locations within the coastline. This methodology is congruent with Integrated Coasts view that coastal study adaptation is a 'bottom up' process, and not a regional process. Because the features of the coastline may vary significantly within a few minutes walking distance, so too does coastal vulnerability vary. This local nature of adaptation is the reason that coastal study requires sectioning in accordance with geological type.

Figure 19: Conceptual illustration



Coastal tour methodology

The methodology employed for the Marion coastline tour:

- Desktop review using Google Earth and Maps
- Walking tour on 29th and 30th August (using voice recorder and camera)
- Aerial tour (with drone) on 1st September, and 17th September.

Purpose of the tour

The purpose of the tour is to identify and photograph:

- All coastal protection structures
- Storm water outlets
- Locations where erosion has been evident
- Locations where inundation may have occurred
- The condition of dunes and cliffs (the escarpment)
- Nature of vegetation cover

4. Assessment

The following vulnerability assessment is conducted as a qualitative exercise in ‘scoping mode’ in the context of the following parameters:

Hazards⁵⁶

- Erosion
- Sea-water inundation

Receiving environments

- Public infrastructure
- Private infrastructure
- Public safety
- Coastal eco-systems

Geological assessment:

Coastal Hazard Wheel (CHW) assigns an outlook rating based on landform typology in the context of climate change over the next hundred years. This rating does not suggest that areas rated as low are free from vulnerability, nor conversely that areas rated more highly are necessarily vulnerable now.

The majority of the Marion coastline (Sections 1,2,3,5) was rated as either ‘hard rock sloping shores’ (R-1) and ‘soft rock sloping shores’ (SR-10) and therefore the hazard outlook for these areas are all ‘low’ apart from ‘soft rock’ locations which are assigned an outlook rating of ‘moderate’. The exception to this rating was the Field River Area (Section 4) which was assigned as Class-TSR and given much higher hazard ratings (Figure 20). Further analysis in Phase 2 of this study will quantify more accurately risk outlook for Field River.

Figure 21: Inherent risk rating of Field River

| | Low | Moderate | High | Very high |
|----------------------|-----|----------|------|-----------|
| Ecosystem disruption | 1 | 2 | 3 | 4 |
| Gradual inundation | 1 | 2 | 3 | 4 |
| Salt water intrusion | 1 | 2 | 3 | 4 |
| Erosion | 1 | 2 | 3 | 4 |
| Flooding | 1 | 2 | 3 | 4 |

In summary, as the majority of Marion coastline falls into low (or moderate erosion) categories, the general outlook for Marion Council as a whole is assigned a low inherent hazard rating in coastal areas in the face of climate change.

Historical assessment:

In line with the general assessment (see above), there have been relatively few inundation or erosion incidents along the coastline:

- Section 3, Hallett Cliffs: A land slip at the Esplanade, Hallett Cove occurred in 1996 but the cause was not assigned to coastal processes, but underlying geological causes. A very ‘wet winter’ and uncontrolled storm water run-off was likely a contributing factor.

⁵⁶ The impact of storm water will be taken into account in Phase 2 of this study.

- Section 3, Hallett Cove Beach: May 9th, 2016 caused erosion of the Heron Reserve embankment.
- Section 4, Field River: Hallett Cove Coastal Management Study (HCCMS) identified erosion occurring in the dunes to the north of Field River, and the sand spit to the south of the river.
- Historically, storm water erosion has been identified by the Council as a management issue and study completed for Sections 2-4.

Risk assessment:

The procedure to evaluate potential risk from hazards in each of the coastal sections:

- Display large photographs of each section of the coast north to south,
- Identify key data such as distances of infrastructure to escarpments, existing protection structures, key coastal features, current wave and tidal regimes, and to note any previous events in the locality,
- Include data from the Hallett Cove Coastal Management Study in sections 3-5.

Each section of coast includes a general risk assessment for erosion (and inundation if relevant). In places where a risk 'hotspot' is identified, the hotspot locality is afforded its own assessment.

The risk assessment tables utilise two main time frames: current and 2100. The 'current' time frame includes events likely to occur within a decade. The longer-range future time frame is intentionally utilised so as to determine the underlying long-term trends more clearly, and thus identifying localities which are more likely to require remedial action.

Integrated Coasts has reviewed National Emergency Risk Assessment Guidelines (NERAG)⁵⁷, CoastAdapt risk assessment templates, and Coastal Hazard Wheel as examples of suitable risk procedures meeting Australian and International risk assessment standards. In this project, risk assessment procedures have been used to harmonize with the nomenclature and procedures outlined in Marion Council's Risk Management Framework. In particular, the assignment of 'likelihood' and 'consequence' ratings are based upon the criteria found in Appendix 2. However, Marion Council's risk matrix does not account for potential losses to private infrastructure such as residential housing. This risk assessment therefore assigns consequences to private infrastructure in accordance with the following table⁵⁸.

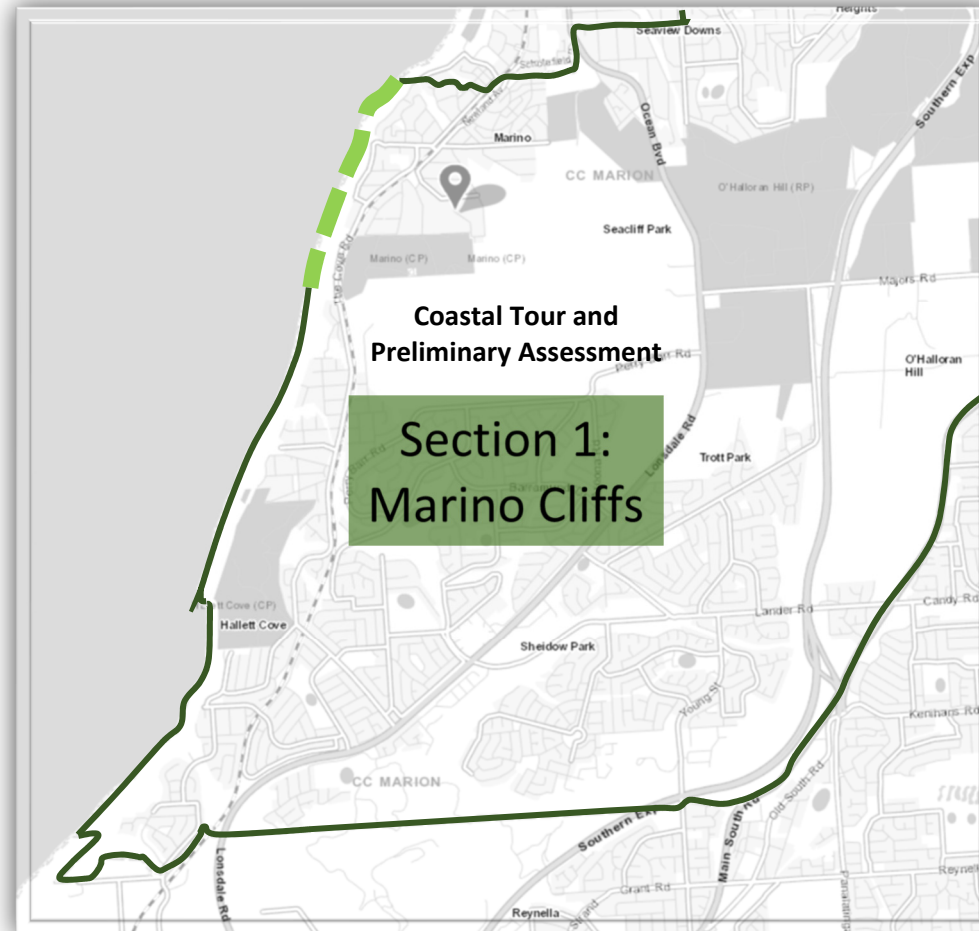
| | Percentage loss of current value of entire property in cases of erosion | Relationship of erosion escarpment to the property |
|---------------|---|--|
| Insignificant | < 5% | Erosion comes within 10m of boundary |
| Minor | 5-10% | Erosion comes within 5m of boundary |
| Moderate | 10-25% | Erosion impacts the boundary |
| Major | 25-50% | Erosion impacts inside the boundary |
| Severe | >50% | Erosion impacts the dwelling |

In this table, losses include both damages to property as well as likely loss of market value. This evaluation is somewhat arbitrary, as there are no known studies or statistics to draw upon from which to ascribe accurate percentage values. (Note: there are methods used by insurance companies to determine potential losses resulting from inundation over floor levels).

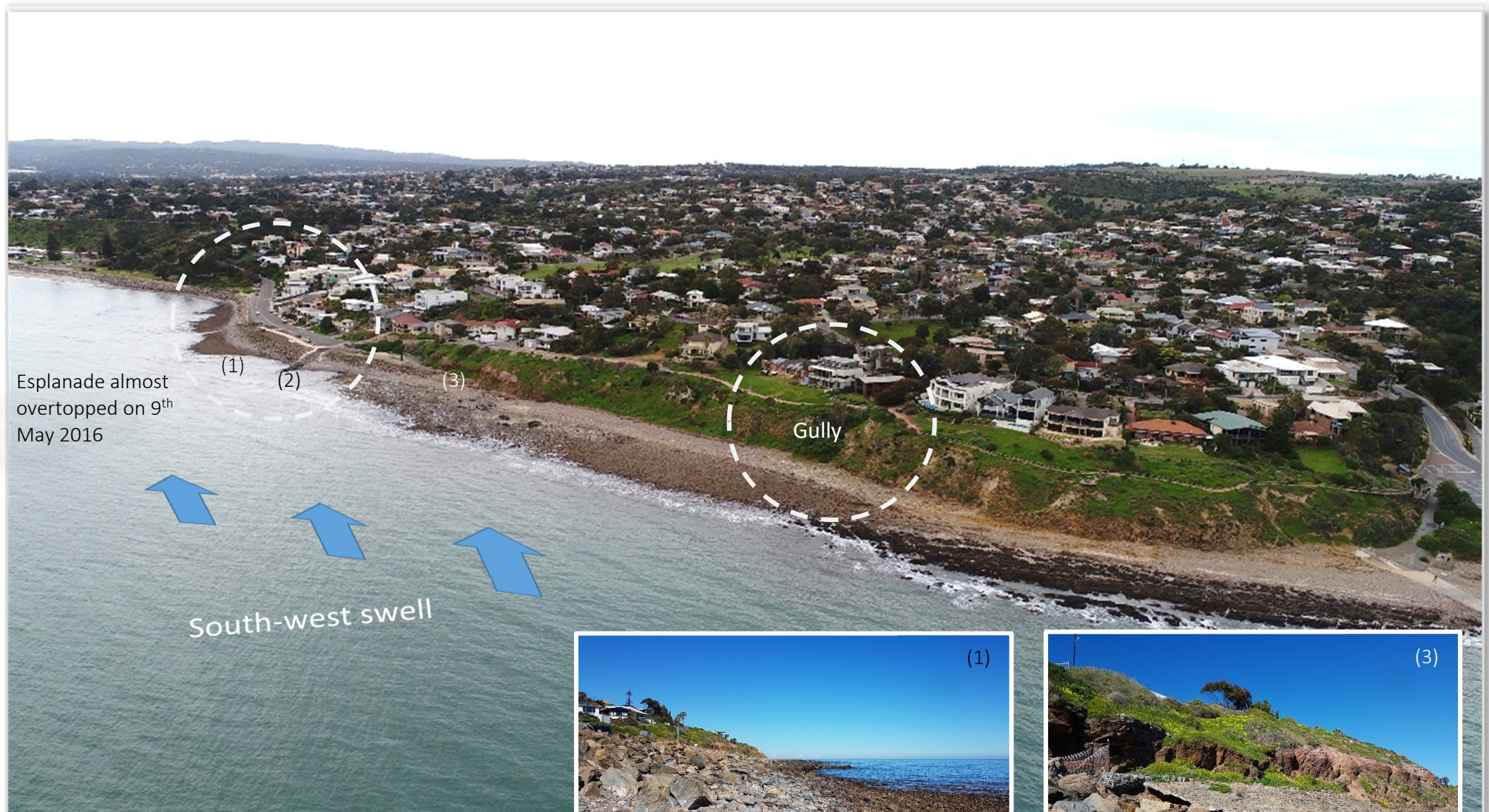
Recommendations that flow from the risk assessment are included in Part 5 of this document.

⁵⁷ Also utilised by SAFECOM

⁵⁸ Similar to technique used by Council when dealing with 'projects' under its 'financial' category.



Section 1: Marion Cliffs (1)



Rock revetment protecting The Esplanade is degrading (1). Small groyne exists (see above) perhaps to act as protection for small boat launching in the past (2). Protection structure (3) is likely to have protected former building, now undermined with erosion.



Section 1: Marion Cliffs (1)



Section 1: Marion Cliffs (2)



Section 1: Marion Cliffs (3)



Prior slump not related to coastal processes but the toe of this gully may become vulnerable to seawater intrusion in future sea level rise scenarios. Storm water drains from the road in this area. Check to ascertain how it is controlled



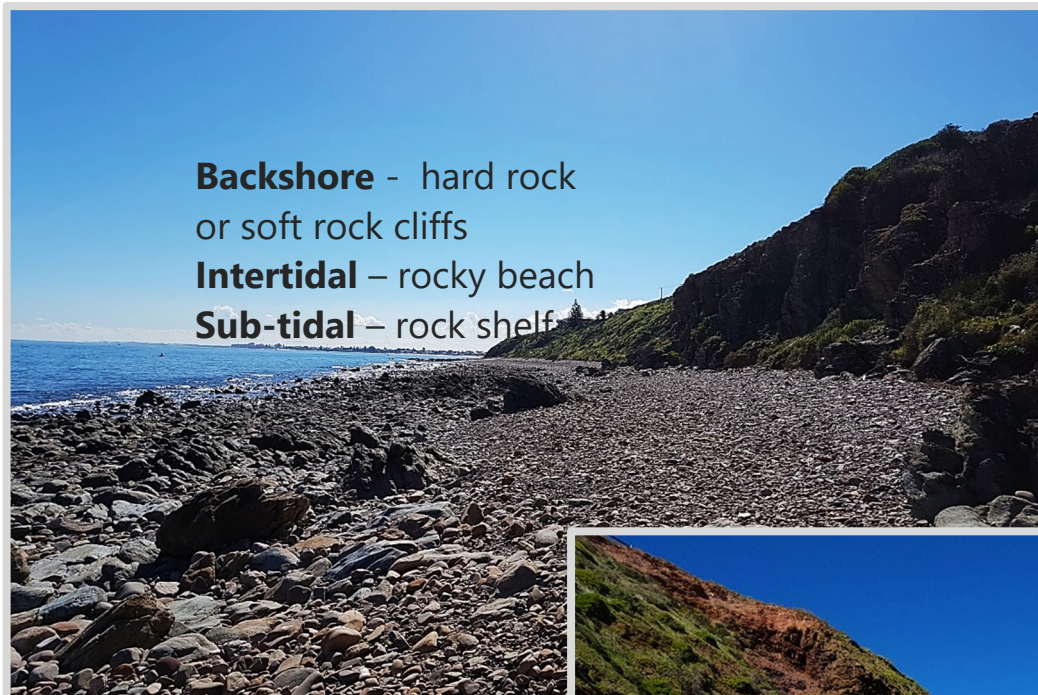
Section 1: Marion Cliffs (4)



Falling rocks hazard contained with wire netting. Beach access stairs may come under increasing impact from sea processes but improved design can cater for impacts when stairs are upgraded. Check to ascertain if stormwater is draining through the gully.



Section 1: Marion Cliffs



Very little evidence that sea processes are currently impacting the toe of cliffs.



Weathering of cliff tops is occurring in places along this section of coast.



Risk assessment: Marino Cliffs

General erosion assessment

Risk identification: Erosion is currently, or may in the future, impact the stability of cliffs in Section 1.

| | |
|--------------------------|--|
| Coastal processes | Storm surge and wave action hits this part of the shoreline obliquely (especially in vicinity of The Esplanade). The geology of the region is classified as soft rock/ hard rock sloping shores with rocky beach (intertidal zone), and rock shelf in sub-tidal zone. Sediment supply issues are not relevant in this region. Observation tour found little evidence of erosion activity at the base of the cliff. |
|--------------------------|--|

Are any strategies employed to mitigate the risk? No (and the assessment assumes that no action is taken to mitigate the risk)

| Receiving environment | Coastal Context | Time | Likelihood | Consequence | Risk |
|------------------------------|---|---------|-----------------|----------------------|--------|
| Public infrastructure | Consists of – esplanade roads, carparks, s/w infrastructure, boat ramp, walking path and beach stairs, foreshore furniture and artwork | current | <i>Rare</i> | <i>Moderate</i> | low |
| | | 2100 | <i>Possible</i> | <i>Major</i> | high |
| Private assets | Most houses sit behind esplanade roads and risk is dependent on Council actions. In other places, most houses set back +15m (3 exceptions) | current | <i>Rare</i> | <i>Moderate</i> | low |
| | | 2100 | <i>Unlikely</i> | <i>Major</i> | medium |
| Safety of people | People live and recreate in the region. Walking trail. The foreshore region is not used extensively by the public (apart from The Esplanade area) | current | <i>Rare</i> | <i>Insignificant</i> | low |
| | | 2100 | <i>Rare</i> | <i>Insignificant</i> | low |
| Ecosystem disruption | Inter-tidal zone is rocky beach, backed by hard rock/ soft rock cliffs. | current | <i>Unlikely</i> | <i>Insignificant</i> | low |
| | | 2100 | <i>Unlikely</i> | <i>Insignificant</i> | low |

Inherent Hazard Rating

Hard /soft rock sloping shores
(R-1 and SR-10)

| | Low | Moderate | High | Very high |
|----------------------|-----|----------|------|-----------|
| Ecosystem disruption | X | 2 | 3 | 4 |
| Gradual inundation | X | 2 | 3 | 4 |
| Salt water intrusion | X | 2 | 3 | 4 |
| Erosion | X | X | 3 | 4 |
| Flooding | X | 2 | 3 | 4 |

Erosion Hazard Rating (current outlook)

| | Low | Medium | High | Extreme |
|-----------------------|-----|--------|------|---------|
| Public Infrastructure | X | | | |
| Private Assets | X | | | |
| Public safety | X | | | |
| Ecosystem disruption | X | | | |

Erosion Hazard Rating (future outlook)

| | Low | Medium | High | Extreme |
|-----------------------|-----|--------|------|---------|
| Public Infrastructure | | | X | |
| Private Assets | | X | | |
| Public safety | X | | | |
| Ecosystem disruption | X | | | |

Note: the assignment of future risk assumes that no action is taken to mitigate the risk apart from normal safety procedures.

Rain intensity and storm water impacts not assessed in this risk assessment

Summary

Although the geological hazard rating is overall low, the proximity of Council infrastructure and private infrastructure at the edge of the cliff escarpment, combined with the *possible* impact of sea water action at the base of the cliff, results in a medium to high hazard outlook. Quantifying the fabric of the cliffs and quantifying the likely sea water regime at the base of the cliffs (taking into account sea level rise over time), may reduce this risk assessment to 'medium' or 'low' risk.

Risk assessment: Marino Cliffs

Hotspot Assessment:
Marino Rocks Carpark



| | |
|-----------------------------|---|
| Technical context (studies) | No studies exist for this region. Council does have record of all stormwater infrastructure and outlets. |
| Historical Context | The original subdivision was completed in England and had no regard to the geological context when placing Marine Parade. CPB (1997) recommended that proposed restaurant be refused unless certain conditions were met. CPB noted possibility of increased erosion in the context of climate change. CPB transferred liability to Council for ongoing protection of the carpark and Marine Pde. The storm event of 9 th May 2016 may be the first time the base of this cliff has been eroded (or this event certainly would have exacerbated it) |
| Coastal context | CHZ assigned this section of coast as 'Soft rock sloping shores' with Moderate Erosion Hazard rating. Observations suggest higher level of sediment in this cliff. Coastal processes are well known in the region. Sediment supply is little consequence in this region (rocky beach/shelf). |
| Climate context | SLR is rising in the Gulf and projected to rise faster. Storm action may become more pronounced (but more likely later in the century). |
| Strategic context | Council has approved Climate Policy, Strategic and Business planning to provide direction in climate adaptation planning and stormwater management. |



Hotspot erosion assessment

Risk assessment: Marino Cliffs

Risk identification: Erosion is currently impacting the base of the cliff adjacent Marino Rocks carpark that may lead to a landslide

| | |
|--------------------------|--|
| Coastal processes | The geology of the cliff adjacent the carpark is classified as soft rock (with observed high content of sediment) with rocky beach (intertidal zone), and rock shelf in sub-tidal zone. Coastal tour on 28th August identified minor erosion characteristics to the base of the escarpment. If the sea was to rise 1m by 2100, then it is very likely that erosion would undermine this cliff. |
|--------------------------|--|

Are any strategies employed to mitigate the risk? No (and the assessment assumes that no action is taken to mitigate the risk)

| Receiving environment | Coastal Context | Time | Likelihood | Consequence | Risk |
|------------------------------|---|---------|------------|---------------|---------|
| Public infrastructure | Marino Rocks carpark, Marine Parade road reserve adjacent. | current | Rare | Severe | medium |
| | | 2100 | Likely | Severe | extreme |
| Private assets | Marino Rocks Restaurant sits behind Marine Parade. It isn't likely that if the carpark failed that Council would not mitigate the risk to the restaurant. | current | Rare | No risk | no risk |
| | | 2100 | Unlikely | Major | medium |
| Safety of people | People use the carpark frequently to access the restaurant or the boat ramp area. Also likely to be a place to park while walking the coastal trail. | current | Rare | Major | low |
| | | 2100 | Rare | Severe | medium |
| Eco-system disruption | Inter-tidal zone is rocky beach, backed by soft rock cliff. | current | Unlikely | Insignificant | low |
| | | 2100 | Unlikely | Insignificant | low |

Inherent Hazard Rating

Soft rock sloping shores
(SR-10)

| | Low | Moderate | High | Very high |
|----------------------|-----|----------|------|-----------|
| Ecosystem disruption | X | 2 | 3 | 4 |
| Gradual inundation | X | 2 | 3 | 4 |
| Salt water intrusion | X | 2 | 3 | 4 |
| Erosion | 1 | X | 3 | 4 |
| Flooding | X | 2 | 3 | 4 |

Erosion Hazard Rating (current outlook)

| | Low | Medium | High | Extreme |
|-----------------------|---------|--------|------|---------|
| Public Infrastructure | | X | | |
| Private Assets | No risk | | | |
| Public safety | X | | | |
| Ecosystem disruption | X | | | |

Erosion Hazard Rating (future outlook)

| | Low | Medium | High | Extreme |
|-----------------------|-----|--------|------|---------|
| Public Infrastructure | | | | X |
| Private Assets | | X | | |
| Public safety | | X | | |
| Ecosystem disruption | X | | | |

Note: the assignment of future risk assumes that no action is taken to mitigate the risk apart from normal safety procedures.

Rain intensity and storm water impacts not assessed in this risk assessment

Summary

The inherent geological hazard rating in this location is moderate (observation suggests higher amounts of sediment in this cliff). The proximity of the carpark at the edge of the escarpment, combined with observed minor erosion at the base of the cliff elevates the risk profile. A DEM on which to conduct tidal and flood scenarios would quantify the likely future regime at the base of the cliff and this study would inform the necessary protection works. Geological analysis of the cliff would add to the risk picture.

General inundation assessment

Risk identification: Inundation is currently, or may in the future, impact Section 1.

| | |
|--------------------------|---|
| Coastal processes | Storm surge and wave action hits this part of the shoreline obliquely (especially in vicinity of The Esplanade). The geology of the region is classified as soft rock/ hard rock sloping shores with rocky beach (intertidal zone), and rock shelf in sub-tidal zone. Sediment supply issues are not relevant in this region. Anecdotal evidence reported that the storm surge of 9 th May, 2016 almost overtopped the rock armour adjacent The Esplanade. |
|--------------------------|---|

Are any strategies employed to mitigate the risk? In the northern part of Section 1, rock armour (in fair condition) reduces wave exposure

| Receiving environment | Coastal Context | Time | Likelihood | Consequence | Risk |
|------------------------------|---|---------|------------|---------------|---------|
| Public infrastructure | Consists of – esplanade road reserve, s/w infrastructure, walking trail, foreshore furniture and artwork. Rock armour and small rock groyne on beach. | current | Unlikely | Minor | low |
| | | 2100 | Likely | Moderate | high |
| Private assets | Houses within Marion Council are situated behind the esplanade road and set higher than the road. | current | Rare | No risk | no risk |
| | | 2100 | Unlikely | Minor | low |
| Safety of people | People live and recreate in the region. Walking trail. The foreshore region is not used extensively by the public (apart from The Esplanade area) | current | Rare | Minor | low |
| | | 2100 | Unlikely | Moderate | medium |
| Eco-system disruption | Inter-tidal zone is rocky beach, backed by hard rock/ soft rock cliffs. | current | Unlikely | Insignificant | low |
| | | 2100 | Unlikely | Insignificant | low |

Inherent Hazard Rating

Hard /soft rock sloping shores
(R-1 and SR-10)

| | Low | Moderate | High | Very high |
|----------------------|-----|----------|------|-----------|
| Ecosystem disruption | X | 2 | 3 | 4 |
| Gradual inundation | X | 2 | 3 | 4 |
| Salt water intrusion | X | 2 | 3 | 4 |
| Erosion | X | X | 3 | 4 |
| Flooding | X | 2 | 3 | 4 |

Inundation Hazard Rating (current outlook)

| | Low | Medium | High | Extreme |
|-----------------------|---------|--------|------|---------|
| Public Infrastructure | X | | | |
| Private Assets | No risk | | | |
| Public safety | X | | | |
| Ecosystem disruption | X | | | |

Inundation Hazard Rating (future outlook)

| | Low | Medium | High | Extreme |
|-----------------------|-----|--------|------|---------|
| Public Infrastructure | | | X | |
| Private Assets | X | | | |
| Public safety | | X | | |
| Ecosystem disruption | X | | | |

Note: the assignment of future risk assumes that no action is taken to mitigate the risk apart from normal safety procedures.

Rain intensity and storm water impacts not assessed in this risk assessment

Summary

Anecdotal accounts state that water almost over-topped The Esplanade on 9th May 2016 (at least a 1 in 20 event). It is unlikely in current day for water to overtop the Esplanade and the impact could expect to be minor. However, with an increase of sea level by 1m, this area is likely to be inundated much more frequently. Identifying the height of 9th May, and conducting scenario planning for 2100 within a DEM will quantify this risk.



Section 2: Hallett Cliffs (1)

Note: measurements to escarpment are from buildings (not allotment boundaries)



High tide 17/09/17 (2.03CD)

High tide was 2.03CD (high tides can be 2.30 to 2.50). Demonstrates that constant wave action is unlikely at cliff base. Houses set back in excess of 20m from top of escarpment (apart from first two on northern end. Cliff slope 45 degrees?)

Section 2: Hallett Cliffs (2)



High tide was 2.03CD (high tides can be 2.30 to 2.50). It is likely that some sections of this cliff base is receiving constant wave action. Houses are set well back from the escarpment which is much more vertical in this location. (Check house on south side)



Section 2: Hallett Cliffs (3)



High tide was 2.03CD (high tides can be 2.30 to 2.50). It is likely that some sections of this cliff base is receiving constant wave action. Houses are set well back from the escarpment in this location which is almost vertical. Note: the house within the circle is situated in a gully between two cliffs. Check to see storm water drainage in the area.

Section 2: Hallett Cliffs (4)



High tide was 2.03CD (high tides can be 2.30 to 2.50). It is likely that some sections of this cliff base is receiving constant wave action. The Esplanade Road is set back only a couple of metres from the top of the escarpment. Houses are set back about 15m. (See hotspot assessment below for The Esplanade)

Section 2: Hallett Cliffs (5)



High tide was 2.03CD (high tides can be 2.30 to 2.50). The Esplanade Road is set back only a couple of metres from the top of the escarpment. Houses are set back about 15m. A landslide occurred in this location in 1996-1997 and the cliff was subsequently collapsed to decrease the slope of the escarpment. Fortunately, this area does not appear to be receiving constant wave action at the base. (See hotspot risk assessment)

Section 2: Hallett Cliffs (6)



Clifftop Road is set back only five metres from the top of the escarpment. Two houses near the corner are set back about 15m from the cliff top. The remainder of the houses on Clifftop Cres are set back in excess of 30m. The base of the cliff in this area does not appear to be receiving constant wave action. High tide was 2.03CD (high tides can be 2.30 to 2.50). (See hotspot risk assessment below)

Section 2: Hallett Cliffs (7)



Section 2: Hallett Cliffs (8)



Section 2: Hallett Cliffs (9)



Risk assessment: Hallett Cliffs

General erosion assessment

Risk identification: Wave action is currently, or may in the future, impact the base of the cliffs causing them to become unstable.

| | |
|--------------------------|--|
| Coastal processes | The geology of this sector is classified as soft rock/ hard rock sloping shores with rocky beach (intertidal zone), and rock shelf in sub-tidal zone. Constant wave action at the base of the cliffs can undermine their long-term stability and sea level rise will exacerbate the impact. While cliff collapses are rare, the impact is catastrophic, and therefore risk should be analysed. All public and private assets are situated on top of the cliffs, apart from the base of the stairs. |
|--------------------------|--|

Are any strategies employed to mitigate the risk? No (and the assessment assumes that no action is taken to mitigate the risk)

| Receiving environment | Coastal Context | Time | Likelihood | Consequence | Risk |
|------------------------------|---|---------|------------|---------------|--------|
| Public infrastructure | The walking trail will undergo upgrades over time (and new designs can cater for changes in coastal environment). Note: The Esplanade and Cliff Cres roads are assessed as a hotspot below. | current | Rare | Minor | low |
| | | 2100 | Unlikely | Minor | low |
| Private assets | Most houses are set back in excess of 20 metres from the top of the escarpment (see pages above for the exceptions). | current | Rare | Major | medium |
| | | 2100 | Rare | Major | medium |
| Safety of people | People are normally confined to the walking trail. Increased erosion may result in more falling stones and rocks. | current | Rare | Minor | low |
| | | 2100 | Unlikely | Minor | low |
| Ecosystem disruption | Inter-tidal zone is rocky beach, backed by hard rock/ soft rock cliffs. | current | Unlikely | Insignificant | low |
| | | 2100 | Unlikely | Insignificant | low |

Inherent Hazard Rating

Soft rock sloping shores
(SR-10)

| | Low | Moderate | High | Very high |
|----------------------|-----|----------|------|-----------|
| Ecosystem disruption | X | 2 | 3 | 4 |
| Gradual inundation | X | 2 | 3 | 4 |
| Salt water intrusion | X | 2 | 3 | 4 |
| Erosion | X | X | 3 | 4 |
| Flooding | X | 2 | 3 | 4 |

Erosion Hazard Rating (current outlook)

| | Low | Medium | High | Extreme |
|-----------------------|-----|--------|------|---------|
| Public Infrastructure | X | | | |
| Private Assets | | X | | |
| Public safety | X | | | |
| Ecosystem disruption | X | | | |

Erosion Hazard Rating (future outlook)

| | Low | Medium | High | Extreme |
|-----------------------|-----|--------|------|---------|
| Public Infrastructure | X | | | |
| Private Assets | | X | | |
| Public safety | X | | | |
| Ecosystem disruption | X | | | |

Note: the assignment of future risk assumes that no action is taken to mitigate the risk apart from normal safety procedures.

Rain intensity and storm water impacts not assessed in this risk assessment

| | |
|----------------|--|
| Summary | Generally houses are well set-back from the escarpment. There are no esplanade roads apart from The Esplanade and Clifftop Crescent (which are assessed below) and therefore risk to Council is low. Wave action has been preliminary assessed, but a DEM would quantify more accurately the current wave regime, and the likely future wave regime as a result of sea level rise. This assessment combined with a geological assessment of the fabric of the cliffs would more adequately quantify the risk in this area. |
|----------------|--|

Hotspot Assessment:
The Esplanade/ Cliff Pde

| | |
|--------------------|--|
| Historical context | <p>The Esplanade subdivision was originally completed in England (1912) It is likely that Clifftop was drawn at the same time. Houses and roads were likely constructed in 1980s.</p> <p>In 1996-1997 a land slip occurred that was deemed to have underlying cause as an agent fault that gave way after a very wet winter, and not as a result of any coastal processes. Neither Council nor the State was deemed legally responsible. The slope was collapsed to increase stability and some houses were acquired (check this). CPB advised that the base of the remedial works would likely to be subject to some wave action (in high events), and that the locality should be monitored.</p> |
| Technical context | <p>Golder and Associates (engineers) completed extensive geotechnical study of the locality and determined that the underlying causes were geological combined with wet winter.</p> |
| Coastal context | <p>CHZ assigned this section of coast as ‘Soft rock sloping shores’ with Moderate Erosion Hazard rating. Intertidal zone is rock and shingle beach, and subtidal is rock shelf. The high tide marks on 30th Aug/ 17th Sept demonstrate tidal range of 2.0CD to 2.2CD (high tide can be 2.5CD). Some erosion action is observed at the base, likely related to extreme events.</p> |
| Climate context | <p>SLR is rising in the Gulf and projected to rise faster. Over the course of this century the base of these cliffs will receive much more constant wave action.</p> |



Risk assessment: Hallett Cliffs

Hotspot erosion assessment

Risk identification: Erosion is, or may in the future, impact the base of the cliffs at the Esplanade/ Clifftop Cres so that they become unstable.

| | |
|--------------------------|---|
| Coastal processes | The geology of this sector is classified as soft rock sloping shores, rocky beach (intertidal zone), and rock shelf in sub-tidal zone. Constant wave action at the base of cliffs can undermine long-term stability and sea level rise will exacerbate the impact. Observation of tides 2.0– 2.2CD suggests that the cliff base at the northern end of The Esplanade is receiving constant wave action, while in the southern sections, wave action is only felt in high-water events. Minor erosion is observed at the base of the landslip. |
|--------------------------|---|

Are any strategies employed to mitigate the risk? No (and the assessment assumes that no action is taken to mitigate the risk)

| Receiving environment | Coastal Context | Time | Likelihood | Consequence | Risk |
|------------------------------|---|---------|------------|---------------|--------|
| Public infrastructure | The Esplanade (2m from the escarpment) and the northern end of Clifftop Cres (5m from the escarpment) (and associated infrastructure and street furniture). | current | Rare | Major | medium |
| | | 2100 | Unlikely | Major | high |
| Private assets | 9 allotments (7 houses) sit behind The Esplanade. 3 houses (close to the escarpment) sit behind Clifftop Cres. One house and one allotment front the cliff. | current | Rare | Major | medium |
| | | 2100 | Unlikely | Major | high |
| Safety of people | People are normally confined to walking trail or road reserve. Unlikely that major collapse would occur without warning (but it is possible) | current | Rare | Insignificant | low |
| | | 2100 | Rare | Insignificant | low |
| Ecosystem disruption | Inter-tidal zone is rocky beach, backed by hard rock/ soft rock cliffs. | current | Unlikely | Insignificant | low |
| | | 2100 | Unlikely | Insignificant | low |

Inherent Hazard Rating

Soft rock sloping shores
(SR-10)

| | Low | Moderate | High | Very high |
|----------------------|-----|----------|------|-----------|
| Ecosystem disruption | X | 2 | 3 | 4 |
| Gradual inundation | X | 2 | 3 | 4 |
| Salt water intrusion | X | 2 | 3 | 4 |
| Erosion | 1 | X | 3 | 4 |
| Flooding | X | 2 | 3 | 4 |

Erosion Hazard Rating (current outlook)

| | Low | Medium | High | Extreme |
|-----------------------|-----|--------|------|---------|
| Public Infrastructure | | X | | |
| Private Assets | | X | | |
| Public safety | X | | | |
| Ecosystem disruption | X | | | |

Erosion Hazard Rating (future outlook)

| | Low | Medium | High | Extreme |
|-----------------------|-----|--------|------|---------|
| Public Infrastructure | | | X | |
| Private Assets | | | X | |
| Public safety | X | | | |
| Ecosystem disruption | X | | | |

Note: the assignment of future risk assumes that no action is taken to mitigate the risk apart from normal safety procedures.

Rain intensity and storm water impacts not assessed in this risk assessment

Summary

The geological hazard rating in this location is moderate erosion. The proximity of road reserves and houses at the edge of the escarpment, combined with observed minor erosion/water action at the base of the cliff elevates the risk profile. A DEM on which to conduct tidal and flood scenarios would quantify the likely future regime at the base of the cliff (risk) and this study would inform any necessary protection works. Geological analysis of the cliff would add to the risk picture.

Risk assessment: Hallett Cliffs

General inundation assessment

Risk identification: Inundation only impacts the base of the cliff area (but sea level rise will increase the depth)

| | |
|--------------------------|--|
| Coastal processes | The geology of the region is classified as soft rock/ hard rock sloping shores with rocky beach (intertidal zone), and rock shelf in sub-tidal zone. Sediment supply issues are not relevant in this region. The height AHD of cliffs is in excess of 20m for the vast majority of Section 2. Council reports that people accessing the base of the cliff areas sometimes get 'caught' by incoming tides. Sea level rise will tend to exacerbate the risk of people being trapped by incoming tides. |
|--------------------------|--|

Are any strategies employed to mitigate the risk? No (Check – there may be warning signs)

| Receiving environment | Coastal Context | Time | Likelihood | Consequence | Risk |
|------------------------------|---|---------|------------|---------------|---------|
| Public infrastructure | Public infrastructure is confined to access stairs. (See erosion above) There is no risk of inundation of these assets. | current | Rare | Insignificant | low |
| | | 2100 | Rare | Insignificant | low |
| Private assets | Nil. | current | Rare | No risk | no risk |
| | | 2100 | Rare | No risk | no risk |
| Safety of people | Council reports that sometimes people accessing the beach at the base of the cliffs become trapped by incoming tide. Sea level rise will exacerbate this problem. | current | Rare | Minor | low |
| | | 2100 | Unlikely | Moderate | medium |
| Eco-system disruption | Inter-tidal zone is rocky beach, backed by hard rock/ soft rock cliffs. | current | Unlikely | Insignificant | low |
| | | 2100 | Unlikely | Insignificant | low |

Inherent Hazard Rating

Soft rock sloping shores
(SR-10)

| | Low | Moderate | High | Very high |
|----------------------|-----|----------|------|-----------|
| Ecosystem disruption | X | 2 | 3 | 4 |
| Gradual inundation | X | 2 | 3 | 4 |
| Salt water intrusion | X | 2 | 3 | 4 |
| Erosion | X | X | 3 | 4 |
| Flooding | X | 2 | 3 | 4 |

Inundation Hazard Rating (current outlook)

| | Low | Medium | High | Extreme |
|-----------------------|---------|--------|------|---------|
| Public Infrastructure | X | | | |
| Private Assets | No risk | | | |
| Public safety | X | | | |
| Ecosystem disruption | X | | | |

Inundation Hazard Rating (future outlook)

| | Low | Medium | High | Extreme |
|-----------------------|---------|--------|------|---------|
| Public Infrastructure | X | | | |
| Private Assets | No risk | | | |
| Public safety | X | | | |
| Ecosystem disruption | X | | | |

Note: the assignment of future risk assumes that no action is taken to mitigate the risk apart from normal safety procedures.

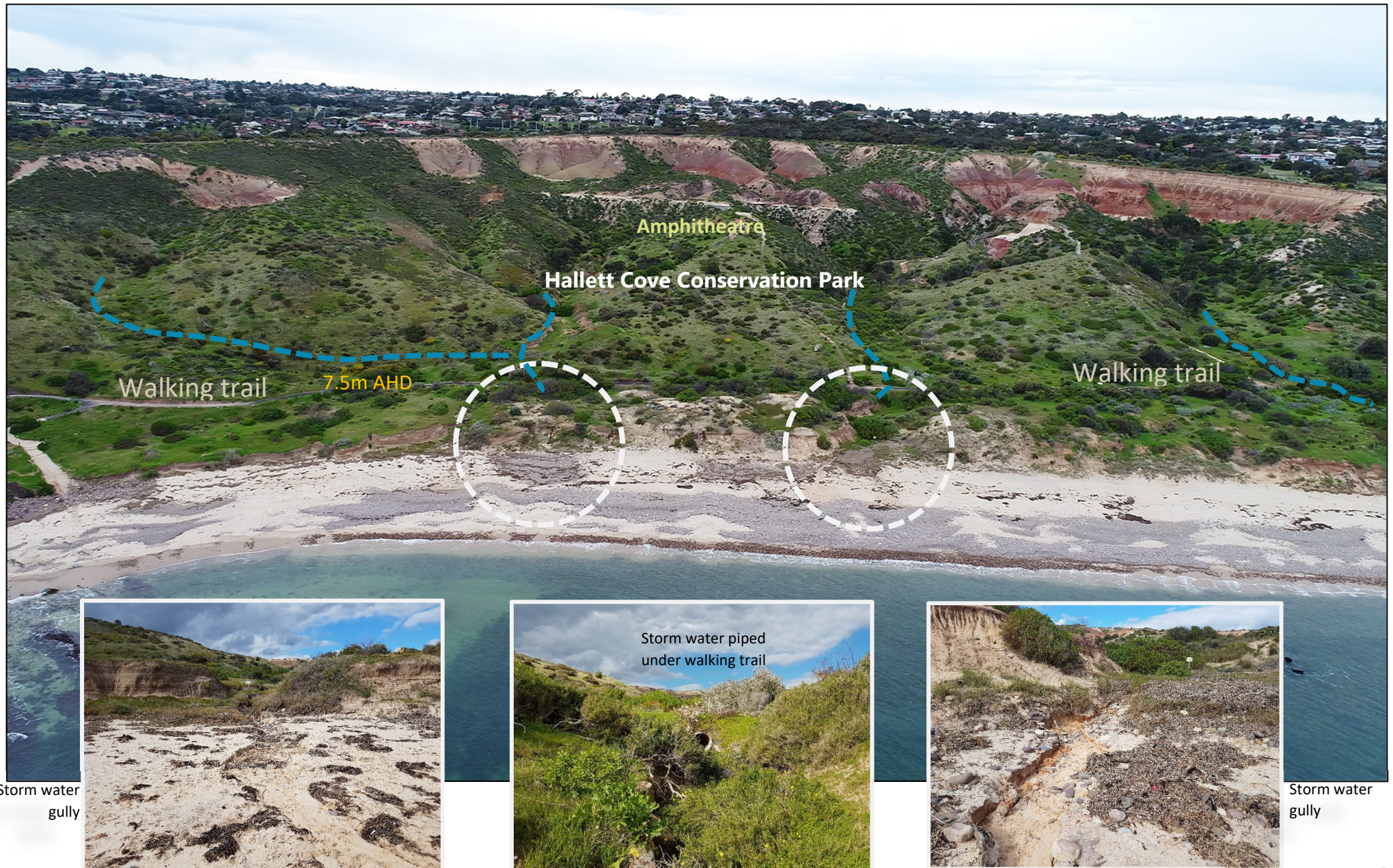
Rain intensity and storm water impacts not assessed in this risk assessment

Summary

Anecdotal accounts state that water almost over-topped The Esplanade on 9th May 2016 (at least a 1 in 20 event). It is unlikely in current day for water to overtop the Esplanade and the impact could expect to be minor. However, with an increase of sea level by 1m, this area is likely to be inundated much more frequently. Identifying the height of 9th May, and conducting scenario planning for 2100 within a DEM will quantify this risk.



Section 3: Hallett Beach (1)



Section 3: Hallett Beach (north)



Risk assessment: Hallett Beach (North)

General erosion assessment

Risk identification: Erosion is currently, or may in the future, impact the integrity of the dune system and erode to the walking trail.

| | |
|--------------------------|---|
| Coastal processes | The foreshores of Hallett Cove present as a slowly receding coastline, starved of sediment (HCCMS) Observation tour found little evidence of erosion activity at the base of the dune escarpment. Dunes are well vegetated. Three storm water outlets draining from the amphitheatre have eroded gullies through the dunes. Height of walking trail adjacent boatshed is 10m AHD (HCCMS, p.39) and on northern end of beach is 7.5m AHD. Storm surge policy level is set at 4.7m AHD in 2100. |
|--------------------------|---|

Are any strategies employed to mitigate the risk? No (and the assessment assumes that no action is taken to mitigate the risk)

| Receiving environment | Coastal Context | Time | Likelihood | Consequence | Risk |
|------------------------------|---|---------|------------|-------------|---------|
| Public infrastructure | Walking trail and associated signs and furniture. HCCMS uses Bruin Rule and allows 25m recession by 2100 which suggests dunes will remain intact. But channels cut by storm water put this assessment in doubt at 2100 with intrusion of sea water. | current | Rare | No risk | No risk |
| | | 2100 | Possible | Moderate | medium |
| Private assets | Nil | current | Rare | No risk | No risk |
| | | 2100 | Rare | No risk | No risk |
| Safety of people | People movement is confined to the walk trail or the beach. | current | Rare | No risk | No risk |
| | | 2100 | Rare | No risk | No risk |
| Ecosystem disruption | The distance from the dune escarpment to the walking trail varies between 32m to 45m. Increase sea levels into storm water gullies may exacerbate erosion rate. | current | Possible | Minor | medium |
| | | 2100 | Likely | Moderate | High |

Inherent Hazard Rating

Soft rock sloping shores
(SR-10)

| | Low | Moderate | High | Very high |
|----------------------|-----|----------|------|-----------|
| Ecosystem disruption | X | 2 | 3 | 4 |
| Gradual inundation | X | 2 | 3 | 4 |
| Salt water intrusion | X | 2 | 3 | 4 |
| Erosion | 1 | X | 3 | 4 |
| Flooding | X | 2 | 3 | 4 |

Erosion Hazard Rating

(current outlook)

| | Low | Medium | High | Extreme |
|-----------------------|---------|--------|------|---------|
| Public Infrastructure | No risk | 2 | 3 | 4 |
| Private Assets | No risk | 2 | 3 | 4 |
| Public safety | No risk | 2 | 3 | 4 |
| Ecosystem disruption | 2 | X | 3 | 4 |

Erosion Hazard Rating

(future outlook)

| | Low | Medium | High | Extreme |
|-----------------------|---------|--------|------|---------|
| Public Infrastructure | 2 | X | 3 | 4 |
| Private Assets | No risk | 2 | 3 | 4 |
| Public safety | No risk | 2 | 3 | 4 |
| Ecosystem disruption | 2 | 3 | X | 4 |

Note: the assignment of future risk assumes that no action is taken to mitigate the risk apart from normal safety procedures.

Rain intensity and storm water impacts not assessed in this risk assessment

| | |
|----------------|---|
| Summary | HCCMS evaluated the erosion of the dunes as low risk by 2100, and suggested allowing them to recede with increase of sea level. However, storm water has cut three gullies and combined with increases in sea level will increase the rate of erosion. A DEM upon which to model different sea level rise scenarios will quantify the risk to the dunes more clearly. |
|----------------|---|

Section 3: Hallett Beach (4)



Allowing for sea level rise, recession of foredune to 2100 would impact assets behind the beach. Along the reserve, the steep embankment would continue to realign with each major storm (HCCMS, p. 40) Storm on 9th May 2016 provides insight into behaviour. [into](#)



Repairs, after 9th May 2016 storm surge



Steep embankment 3H:1V (HCCMS p 39)

Section 3: Hallett Beach (5)



Section 3: Hallett Beach (South)



The 9th May, 2016 event demonstrates the impact of storm surge on the Hallett Cove Beach region. This event provides insight as to how seas may behave in the region in the future with higher sea levels.

Risk assessment: Hallett Beach (South)

General erosion assessment

Risk identification: Erosion is currently, or may in the future, undermine the integrity of the Heron Reserve slope.

| | |
|--------------------------|--|
| Coastal processes | Storm surge and wave action hits this part of the shoreline obliquely. HCCMS assesses the slope of the embankment at 1V to 3H at boatshed end, and 1V to 1.5H at southern end. At the base of the sloping embankment, erosion has left a vertical and unstable slope along sections of the beachfront. Storm event of 9 th May, 2016, eroded the embankment in three places (see ps 67.68.69) which have been remediated with soil and compacted. |
|--------------------------|--|

Are any strategies employed to mitigate the risk? Rock armour is situated adjacent the access ramp to the beach.

| Receiving environment | Coastal Context | Time | Likelihood | Consequence | Risk |
|------------------------------|--|---------|-----------------------|----------------------|----------------|
| Public infrastructure | Consists of – Embankment (with rock armour in places) behind which are situated Boatshed Café and carpark, Heron Reserve, s/w infrastructure, walking path, playground and shelter (s). | current | <i>Likely</i> | <i>Moderate</i> | high |
| | | 2100 | <i>Almost certain</i> | <i>Major</i> | extreme |
| Private assets | All houses sit back behind Heron Way and are not likely to be subject to any risk within this century | current | <i>Rare</i> | <i>No risk</i> | No risk |
| | | 2100 | <i>Rare</i> | <i>No risk</i> | No risk |
| Safety of people | People recreate in the region on Heron Reserve and the beach. Coastal processes are unlikely to present any risk to safety of people (above normal activities) | current | <i>Rare</i> | <i>Insignificant</i> | low |
| | | 2100 | <i>Rare</i> | <i>Insignificant</i> | low |
| Ecosystem disruption | Inter-tidal zone is shingle/ sand beach (underlain by clay), and backed by sloping earthen embankment, rock armoured in places. | current | <i>Unlikely</i> | <i>Insignificant</i> | low |
| | | 2100 | <i>Unlikely</i> | <i>Insignificant</i> | low |

Inherent Hazard Rating

Soft rock sloping shores
(SR-10)

| | Low | Moderate | High | Very high |
|----------------------|-----|----------|------|-----------|
| Ecosystem disruption | X | 2 | 3 | 4 |
| Gradual inundation | X | 2 | 3 | 4 |
| Salt water intrusion | X | 2 | 3 | 4 |
| Erosion | 1 | X | 3 | 4 |
| Flooding | X | 2 | 3 | 4 |

Erosion Hazard Rating

(current outlook)

| | Low | Medium | High | Extreme |
|-----------------------|---------|--------|------|---------|
| Public Infrastructure | | | X | |
| Private Assets | No risk | | | |
| Public safety | X | | | |
| Ecosystem disruption | X | | | |

Erosion Hazard Rating

(future outlook)

| | Low | Medium | High | Extreme |
|-----------------------|---------|--------|------|---------|
| Public Infrastructure | | | | X |
| Private Assets | No risk | | | |
| Public safety | X | | | |
| Ecosystem disruption | X | | | |

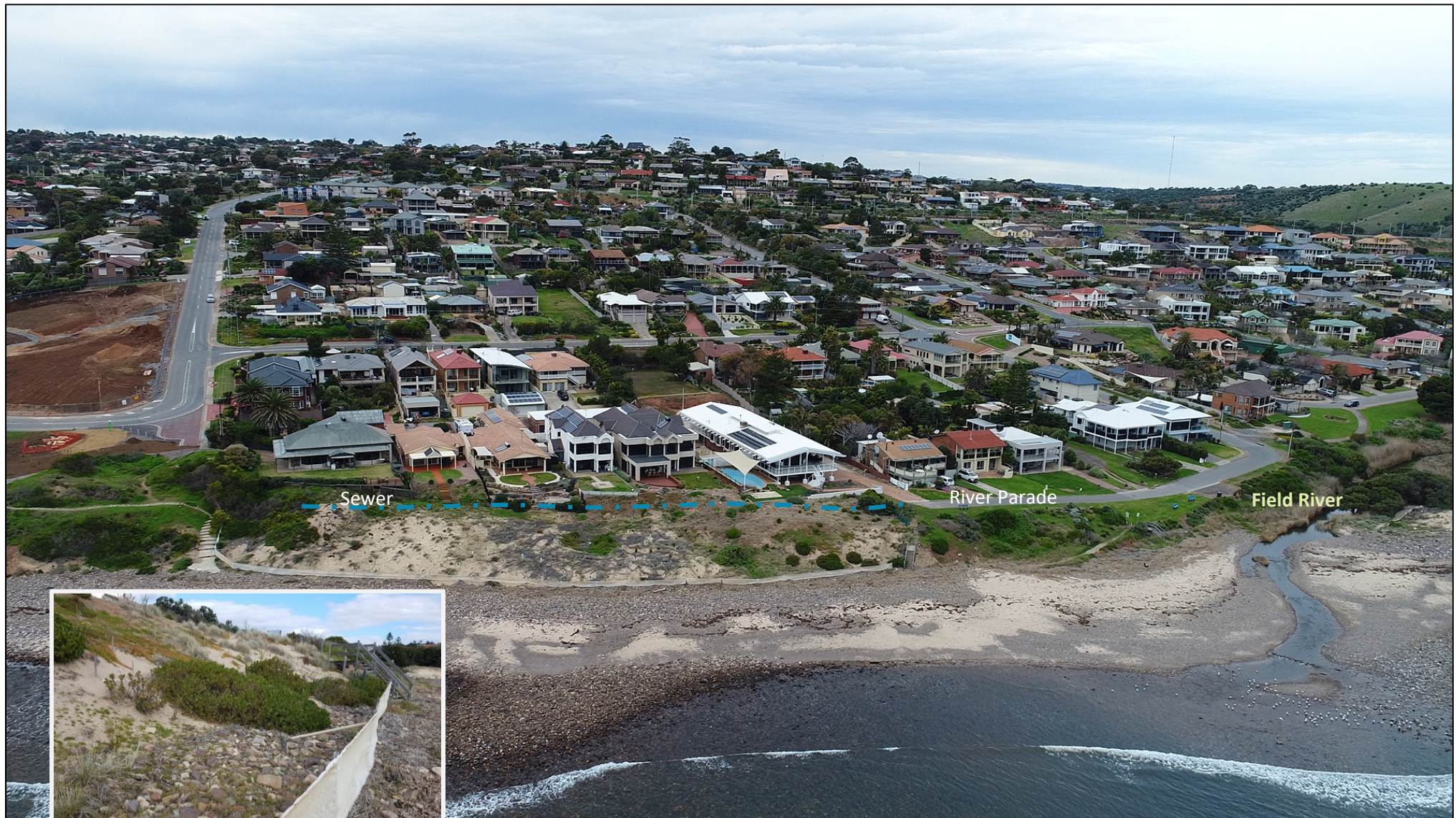
Note: the assignment of future risk assumes that no action is taken to mitigate the risk apart from normal safety procedures.

Rain intensity and storm water impacts not assessed in this risk assessment

| | |
|----------------|---|
| Summary | Storm surge and associated wave action from the South-west are already impacting the slope behind the beach in three locations. Council has remediated these area with soil which can only be viewed as a short term measure. HCCMS states that the slope will increasingly become vertical and more unstable with each new event. Identifying the characteristics of storm event 9 th May, 2016, and DEM modelling will assist in determining the nature of future wave action. |
|----------------|---|



Section 4: Field River (1)



There are twelve beachfront properties, six of which have frontage to the low dunes, and six which have frontage to River Parade. HCCMS (p.42) states that sewer infrastructure is located on the seaward side of the properties. Allowing for 25m of recession by 2100, HCCMS states that these properties and associated infrastructure would be vulnerable to coastal processes.

Section 4: Field River (2)



The boat channel is likely the result of the removal of shingle layer, allowing the underlying clay to erode. As a consequence, storm waves do not break on the shingles but run up the channel, resulting in increased erosion to the back beach. (HCCMS, 42-44).



Section 4: Field River



South west swell impacts the area obliquely. Geological layout as river mouth indicates that by nature this area is more vulnerable to flooding and erosion. Allowing for 25m of recession by 2100, HCCMS states that most of the sand dune and sand spit would be lost, the twelve properties, and road reserve, on the southern side of Field River would be vulnerable to coastal processes, and erosion would impact the seaward portion of the three vacant allotments in the undeveloped subdivision (HCCMS pp 42-44).

Risk assessment: Field River

General erosion assessment

Risk identification: Erosion is currently, or may in the future, threaten the dunes and infrastructure behind the dunes.

| | |
|--------------------------|---|
| Coastal processes | Storm surge and wave action hits this part of the shoreline obliquely. The removal of shingles to form boat channel has exacerbated the erosion of shoreline and dune spit. The underlying geological classification is River Mouth (TSR). How peak river flows relate to sea storm surges is unknown. Storm event of 9 th May, 2016, would provide insight into the nature of coastal processes in a storm surge event and provide a context from which to assess the impacts of future sea level rise. |
|--------------------------|---|

Are any strategies employed to mitigate the risk? Dune fencing to dunes and sand spit, minor rock armour to southern side of sand spit.

| Receiving environment | Coastal Context | Time | Likelihood | Consequence | Risk |
|------------------------------|--|---------|-----------------|----------------------|--------|
| Public infrastructure | River Parade and associated infrastructure (sewer, furniture, signs) | current | <i>Possible</i> | <i>Minor</i> | medium |
| | | 2100 | <i>Likely</i> | <i>Major</i> | high |
| Private assets | Six houses with dune frontage, six houses situated behind River Road (protected as long as Council defends the road), allotments behind the sand spit (undeveloped). | current | <i>Unlikely</i> | <i>Minor</i> | medium |
| | | 2100 | <i>Likely</i> | <i>Major</i> | high |
| Safety of people | The beach in this location is not used to a great extent by the public. There is no walking trail to connect north and south of Field River. | current | <i>Rare</i> | <i>Insignificant</i> | low |
| | | 2100 | <i>Rare</i> | <i>Insignificant</i> | low |
| Ecosystem disruption | Inter-tidal zone is shingle/ sand beach (underlain by clay), and backed by low dunes. Should seas rise as projected, the estuary system could come under threat. | current | <i>Unlikely</i> | <i>Minor</i> | low |
| | | 2100 | <i>Possible</i> | <i>Moderate</i> | medium |

Inherent Hazard Rating

River mouth, sand spit
(TSR)

| | Low | Moderate | High | Very high |
|----------------------|-----|----------|------|-----------|
| Ecosystem disruption | 1 | 2 | 3 | 4 |
| Gradual inundation | 1 | 2 | 3 | 4 |
| Salt water intrusion | 1 | 2 | 3 | 4 |
| Erosion | 1 | 2 | 3 | 4 |
| Flooding | 1 | 2 | 3 | 4 |

Erosion Hazard Rating

(current outlook)

| | Low | Medium | High | Extreme |
|-----------------------|-----|--------|------|---------|
| Public Infrastructure | 1 | 2 | 3 | 4 |
| Private Assets | 1 | 2 | 3 | 4 |
| Public safety | 1 | 2 | 3 | 4 |
| Ecosystem disruption | 1 | 2 | 3 | 4 |

Erosion Hazard Rating

(future outlook)

| | Low | Medium | High | Extreme |
|-----------------------|-----|--------|------|---------|
| Public Infrastructure | 1 | 2 | 3 | 4 |
| Private Assets | 1 | 2 | 3 | 4 |
| Public safety | 1 | 2 | 3 | 4 |
| Ecosystem disruption | 1 | 2 | 3 | 4 |

Note: the assignment of future risk assumes that no action is taken to mitigate the risk apart from normal safety procedures.

Rain intensity and storm water impacts not assessed in this risk assessment

| | |
|----------------|---|
| Summary | Storm surge and associated wave action from the South-west are already impacting the dune system and sand spit. It is unlikely that significant damage to road and property is imminent but sea level rise will increase the impact upon the shoreline, and without intervention recession is probable. Modelling of sea level rise impact on the estuary, and investigation into possible confluence of fresh water outflows from the river, occurring at the same time as sea storm surges should be completed. |
|----------------|---|

Risk assessment: Field River

General inundation assessment

Risk identification: Inundation may in the future impact public and private assets

| | |
|--------------------------|---|
| Coastal processes | The Field River is a small river set in a narrow gully with a high bank on the northern side, and roads and related infrastructure set well above the creek floor. The bank on the south side is lower, but is likely to still provide protection to the land adjacent. Coast Protection Board current sea-flood risk levels are set at 3.7m AHD (including wave set-up and wave run-up). One PSM on River Pde at height 6.81 AHD suggests that River Parade may be set high enough to be at no risk to current or future flooding. |
|--------------------------|---|

Are any strategies employed to mitigate the risk? No

| Receiving environment | Coastal Context | Time | Likelihood | Consequence | Risk |
|------------------------------|--|---------|------------|---------------|---------|
| Public infrastructure | River Parade and associated infrastructure (sewer, furniture, signs). It is likely public infrastructure is set above current and future sea-flood levels. Scenario planning within a DEM will provide the appropriate risk picture. | current | Rare | Insignificant | low |
| | | 2100 | Unlikely | Minor | low |
| Private assets | Six houses with dune frontage, six houses situated behind River Road are likely to be positioned above 2100 risk levels. The allotments behind the sand spit may be affected by inundation (especially if the sand spit eroded away) | current | Rare | No risk | no risk |
| | | 2100 | Unlikely | Minor | low |
| Safety of people | The beach in this location is not used to a great extent by the public. There is no walking trail to connect north and south of Field River. | current | Rare | No risk | No risk |
| | | 2100 | Rare | No risk | No risk |
| Eco-system disruption | Inter-tidal zone is shingle/ sand beach (underlain by clay), and backed by low dunes. Should seas rise as projected, the estuary system could come under threat. | current | Unlikely | Insignificant | low |
| | | 2100 | Possible | Minor | medium |

Inherent Hazard RatingSand spit, River mouth
(TSR)

| | Low | Moderate | High | Very high |
|----------------------|-----|----------|------|-----------|
| Ecosystem disruption | 1 | 2 | 3 | 4 |
| Gradual inundation | 1 | 2 | 3 | 4 |
| Salt water intrusion | 1 | 2 | 3 | 4 |
| Erosion | 1 | 2 | 3 | 4 |
| Flooding | 1 | 2 | 3 | 4 |

Inundation Hazard Rating

(current outlook)

| | Low | Medium | High | Extreme |
|-----------------------|---------|--------|------|---------|
| Public Infrastructure | X | | | |
| Private Assets | No risk | | | |
| Public safety | No risk | | | |
| Ecosystem disruption | X | | | |

Inundation Hazard Rating

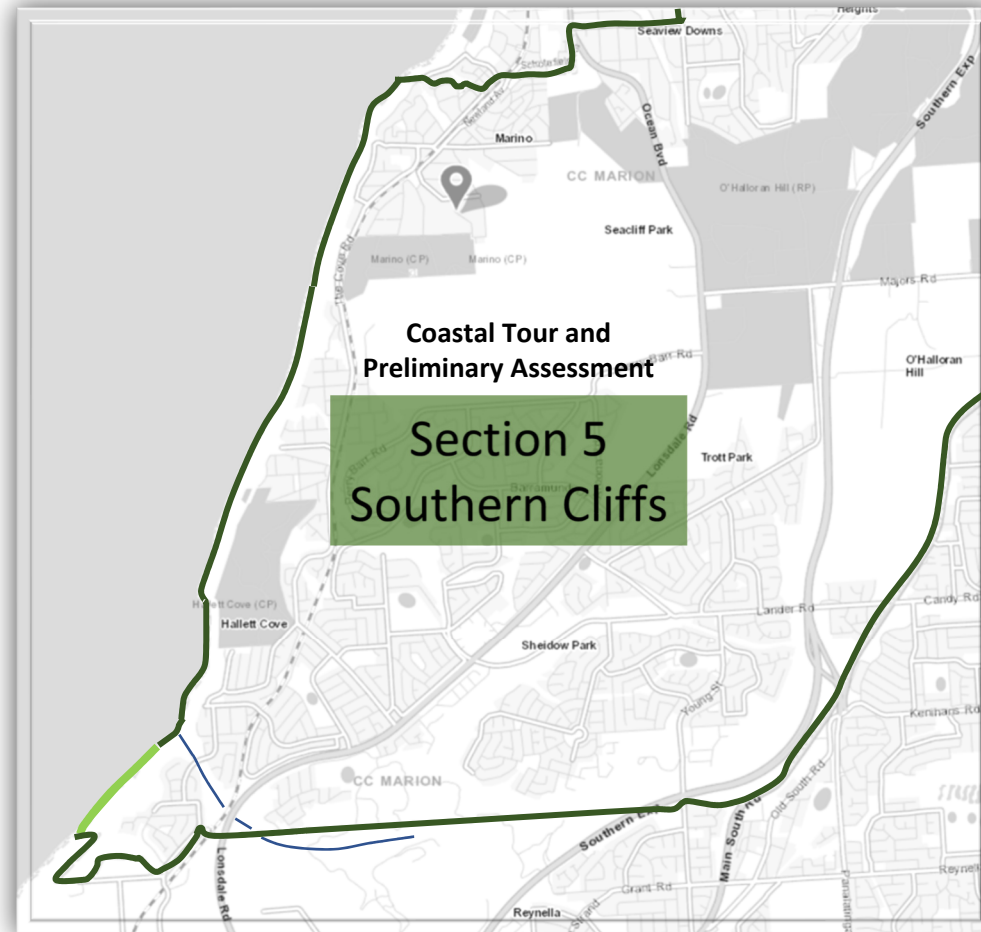
(future outlook)

| | Low | Medium | High | Extreme |
|-----------------------|---------|--------|------|---------|
| Public Infrastructure | X | | | |
| Private Assets | X | | | |
| Public safety | No risk | | | |
| Ecosystem disruption | X | | | |

Note: the assignment of future risk assumes that no action is taken to mitigate the risk apart from normal safety procedures.

Rain intensity and storm water impacts not assessed in this risk assessment

| | |
|----------------|---|
| Summary | Scenario planning for current and future sea-flood levels within a Digital Elevation Model is required to assess the current and future risks more accurately. Increased sea levels may result in sea-water inundation into the estuary, and combined with a likely increase in erosion, may cause changes to the eco-system within the estuary |
|----------------|---|



Section 5: Southern Cliffs (1)



One house is close to the top of the escarpment, but the slope of the embankment is quite low. By 2100, it is likely the base of the cliff will be inundated more frequently, allowing direct wave action against the base of the cliffs. Routine monitoring of the cliff condition and stability should be undertaken (particularly the discharge of stormwater) HCCMS, P. 45

Section 5: Southern Cliffs (2)



All private and public infrastructure is set well-back from cliffs. By 2100, it is likely the base of the cliff will be inundated more frequently, allowing direct wave action against the base of the cliffs. Routine monitoring of the cliff condition and stability should be undertaken (particularly the discharge of stormwater) HCCMS, P. 45

Section 5: Southern Cliffs (3)



All private and public infrastructure is set well-back from cliffs. By 2100, it is likely the base of the cliff will be inundated more frequently, allowing direct wave action against the base of the cliffs. Routine monitoring of the cliff condition and stability should be undertaken (particularly the discharge of stormwater) HCCMS, P. 45

Section 5: Southern Cliffs



No formal risk assessment required for Southern Cliffs (Section 5)

5. Recommendations

This scoping study has already begun to assess risks and vulnerabilities. The next stage of work is to complete an assessment of risks and vulnerabilities which will involve a two-stage process:

First,

- Run sea-level rise scenarios for current, 2050, 2100, 2200.
- Quantify the erosion rates of the past, and in the light of sea-level rise scenarios above, estimate erosion impact by 2050 and 2100.

And then,

- Identify all assets (both private and public) in the coastal zone that may be subject to impact
- Identify any areas where the safety of people may be an issue
- Identify any areas that may be subject to eco-system disruption (CHW)

To be able to complete this process certain data will need to be acquired and assessed. The main purpose of Phase 2 of the scoping study is to acquire digital elevation data, produce various sea flood inundation models, and assess historical erosion rates.

Project tasks:

The following tasks are recommended for Stage 2 of City of Marion Regional Coastal Management Plan:

Task 1:

Obtain photogrammetry and bathymetric mapping for the entire coast and create Digital Elevation Model including:

- Identify required resolution and outputs
- Create tender documents
- Conduct tender process
- Ensure DEM is ground-truthed appropriately (if necessary employ a surveyor. However Task 2 does require a surveyor)
- Bring DEM into Integrated Coast's GIS environment

Reasons:

This mapping will provide an essential baseline from which to benchmark all future changes in the coastal zone and will be essential for ongoing monitoring programs.

This mapping will provide the digital environment upon which to conduct inundation mapping for:

- 9th May, 2016 storm surge event
- Current astronomical tide events (suggest top 10%)
- Current CPB storm surge risk levels for statutory planning purposes
- Scenario planning for rises in sea level of 0.3m (2050) and 1.0m (2100)

Priority:

Essential (v. high). Most of the work below cannot be completed without it.

Synergies:

Note: there might be some synergy with the upgrade of the walking trail (will a high-resolution DEM be of benefit to that project?)

Task 2:

1. Undertake extreme event analysis for May 9th, 2016 at two locations: Field River (Hallett Cove) and The Esplanade (Marino):
 - Obtain photographs of the event from Council and residents (will involve a door knock in each area) (1 day)
 - Analyse photographs and conduct interviews to identify storm water height levels
 - Use the DEM to recreate the flood pattern (1 day)
 - Employ and accompany a surveyor to obtain spot heights at known levels (these last two items are likely to produce a height level within 50mm of the actual event) (1 day)
 - Compare the outcome for accuracy with CPB sea-flood risk benchmark (which should be higher)

Reasons:

May 9th, 2016 was the highest level of water in the Gulf for 80 years and therefore forms a current day benchmark of an extreme event.

Photographs will give an insight into the nature of the event (wave heights and actions) and this forms a benchmark for evaluating future storm scenarios.

This project will validate CPB and Council's current risk levels to be used in Field River area future development (and thereby likely to reduce Council liability)

The project will identify whether any protection measures are likely for The Esplanade (Marino) to halt inundation in higher events.

The project will provide the data for analysis at hot spots along the coast (for example, Marino Carpark, The Esplanade, Hallett Cove, and generally along the base of the cliffs)

Priority:

High. Provides essential bench mark for analysis and communication with public.

Task 3:

Provide inundation modelling (ie flood maps) for all sections of the coast (1-5) for:

- Current astronomical tides (suggest a range – 3 maps)
- CPB current risk levels (which will be higher than (2) above).
- Flood maps to be produced in Sections 1-5 (likely 4 in each section, therefore 20 maps in total)

Reasons:

To understand the current potential for erosion along the coastline (especially in cliff areas which are completely unknown at this stage)

To understand the impact of current CPB storm surge risk levels (statutory) on the coastline, especially in the Field River area, and The Esplanade at Marion. The issue in the cliff area is ongoing erosion, not the occasional battering by a 1 in 100 ARI event.

In particular, flood modelling will form the basis for analysing possible confluence issues in Field River (in Stage 3).

Flood models are excellent communication tools in Council and public forums.

Priority

Essential (v. high)

Task 4:

Produce flood modelling for sea level rise scenarios 2050 (+0.3m) and 2100 (+1.0m) for Sections 1-5:

- Current astronomical tides (suggest a range – 3 maps)
- CPB current risk levels (which will be higher than (2) above).
- Flood maps to be produced in Sections 1-5 (likely 4 in each section, therefore 20 maps in total x two scenarios = 40 maps)

Reasons:

To understand the FUTURE potential for erosion along the coastline (especially in cliff areas which are completely unknown at this stage)

To understand the impact of FUTURE CPB storm surge risk levels (statutory) on the coastline, especially in the Field River area and The Esplanade (Marino). The issue in the cliff area is ongoing erosion, not the occasional battering by a 1 in 100 ARI event.

In particular, flood modelling will form the basis for analysing possible confluence issues in Field River (in Stage 3).

Flood models are excellent communication tools in Council and public forums.

Priority

Essential (v. high)

Task 5:

Photographic analysis to ascertain historical erosion rates:

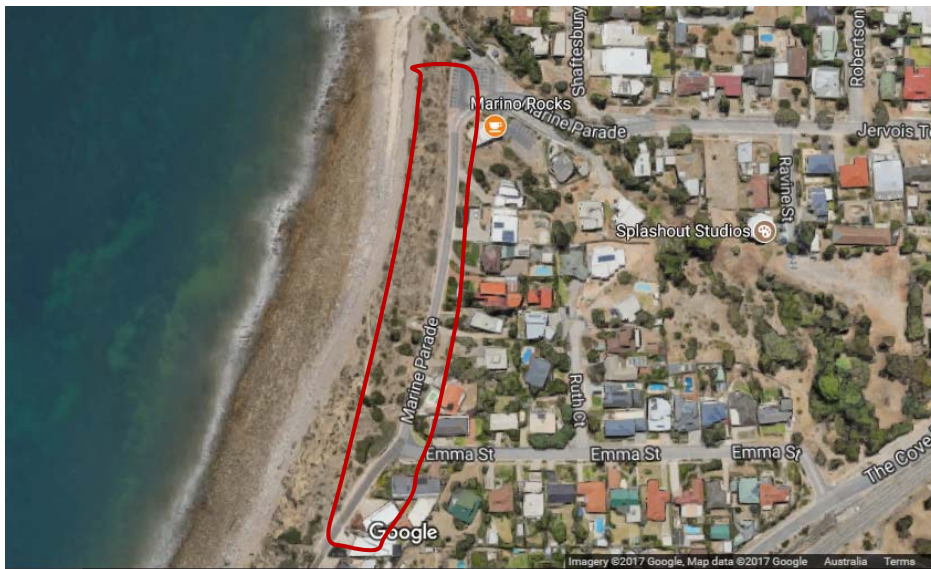
- Section 1-2 for locations where infrastructure is in close proximity to cliff edge.
- Section 3-4 The HCCMS called for quantification of erosion rates in the Beach and Field River Area using photographic analysis.
- Section 5 (southern cliffs) does not require any analysis, unless in relation to the walking trail).

Procedure:

- Obtain aerial photography from earliest period possible (1940s?)
- Geo-reference these into GIS environment (time consuming, each one needs to be done by visual referencing)
- Compare to current satellite images (or within DEM environment)
- Measure changes (especially in locations where infrastructure exists)

Study Areas:

Sections 1 and 2





Section 3-4



Reasons

It may appear unlikely that cliffs (Sections 1,2) have receded, nor that they are at risk from collapse but quantifying the rate of erosion is essential for:

- (1) the geological study as this information will feed directly into quantifying the risk level associated with the cliffs
- (2) Council liability...while the probability of risk collapse is low, the consequence is high. Council is likely to have a defence if it has taken reasonable measures to quantify the risk of collapse (this is not to be taken as legal advice but only to form the rationale for this project).

In relation to Hallett Cove Beach (Section 3) and Field River Area (Section 4), understanding the historical rates of erosion will assist in formulating future rates of erosion. Currently, the HCCMS has estimated rates but recommends that photographic analysis be conducted to enable these estimates to be further quantified.

Priority:

Very high (in relation to cliff areas, because this study will feed into the geological review).

Task 6:

Conduct geological review of cliff areas (Sections 1,2,5) (by others)

- Locate contractor (likely Flinders University)
- Meet with contractor to explain task (0.5)
- Conduct site visit with contractor (0.5)
- Provide data to contractor (maps, cliff recession rates)
- Review reporting and integrate findings within the context of the larger study

Reasons

To classify more accurately the preliminary assignment by CHZ

To establish possible future erosion rates (which is why (5) above is essential)

To review inundation modelling (especially astronomical tide modelling) for current, 2050 and 2100 scenarios. This will assist in determining a 'erosion outlook'.

Review in greater detail the specific hotspot locations (Marino Carpark and the Esplanade, and any others that are located in the study), perhaps using electronic sounding equipment.

Produce preliminary report and make recommendations whether future work is required.

Task 7:

Internal review – Council

a. Conduct audit of all stormwater outlets to ascertain the impact that stormwater may be having (especially in cliff environments)

- Council will have this information in digital format
- Conduct visual audit of all outlet locations (in team with Council) (1 day)

Reasons

CPB has repeatedly warned of storm water impact in cliff stability

Storm water was deemed as one factor in the cliff collapse at The Esplanade (Hallett Cove)

b. Communicate with Council for the purpose of internal review regarding the following:

- adequacy of storm water system to cater for larger flows (in second part of century), and in particular, the capacity of the detention swale system that is currently being installed, and how suitable the design will be for future upgrade to cater for more capacity.
- The construction of Heron Reserve. While this has been approved by CPB, a check should be made to see if the recommendations of the HCCMS have been considered. For example, that study recommended that the slope of the escarpment should be lowered to cater for future impacts from the sea. It is possible, that CPB have assessed the proposal, but not taken all facets relating to climate change into consideration. These matters are fundamental to future successful outcomes over time.
- The proposed construction of walking trail in the Field River Area. Consideration may be required in regard to legal issues.

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