Technical Evidence Appendix Report – Part 2 of 2

Coastal Hazard Adaptation Strategy – Phase 4 and 5

Bundaberg Regional Council

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1 INTRODUCTION

This Technical Evidence Appendix document provides all of the supporting documentation associated with the development of the Phase 4 and 5 Identify Key Assets Potentially Impacted and Risk Assessment in Coastal Hazard Areas for the Bundaberg Region Coastal Hazard Adaptation Strategy.

The analyses undertaken provide an understanding of the coastal hazard challenges and risks. Table 1-1 summarises the content of the Technical Evidence Appendix document.

TABLE 1-1 SUMMARY OF TECHNICAL EVIDENCE APPENDIX DOCUMENT

Part	Description	Appendix
1	**Identification and prioritisation of assets exposed to coastal hazard**	Appendix A – Asset Identification for 5% and 0.2% AEP Storm Tide Inundation Scenarios Appendix B – Environmental Value Mapping Appendix C – Vulnerability Assessment and Asset Prioritisation
2	**Risk assessment of key assets in coastal hazard areas**	Appendix D – Environmental Analysis Technical Summary Report and Environmental Consequence Results Appendix E – Economic and Social Analysis Technical Report and Consequence Results Appendix F – Risk Analysis Results

APPENDIX D - ENVIRONMENTAL ANALYSIS TECHNICAL SUMMARY REPORT AND ENVIRONMENTAL CONSEQUENCE RESULTS

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Assessment of Habitat and Ecosystem Sensitivity for Bundaberg CHAS – June 2019

Introduction

A preliminary method for assigning values to habitats has been addressed in Phase 4. This report identifies a preliminary method of assessing ecosystem and habitat sensitivity and the potential consequences of these habitats to coastal hazard and sea level rise.

Habitat Types

Natural habitat types were defined as remnant Regional Ecosystems sourced from The Queensland Spatial Catalogue[1], including estuaries and small inlets as per this mapping, and the following additional habitats:

- open sandy beach/ sea turtle sensitive area[2]
- rocky headlands
- rocky and coral reefs
- seagrass, and
- soft bottom habitat.

Where mapping was available, habitat types were mapped for each subregion. The current storm tide 1% AEP extent, and the storm tide 1% AEP associated with an 80 cm increase in sea level rise (SLR) by 2100 were overlain (Water Technology Regional Ecosystem Map series 2019).

1 http://qldspatial.information.qld.gov.au/catalogue/custom/detail.page?fid={06ADEB9C-D8DD-40DC-8029-936A16C4A45E}

2 mapping from assessment of aerial http://www.bundaberg.qld.gov.au/services/interactive-mapping, Planning Scheme 2015 – overlays >Coastal Protection.

Regional Ecosystems

Regional ecosystems are vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil (Sattler and Williams 1999, *Vegetation Management Act 1999*).

Regional ecosystem coding is based on three elements (Queensland Government 2016):

- The first element refers to the bioregion. Bundaberg Regional Council is in Bioregion 12: South East Queensland.
- The second element refers to the land zone that the Regional Ecosystem occurs on. The land zone is a simplified geology/substrate-landform classification for Queensland. A description of land zones impacted by increased storm surge and sea-level rise in the Bundaberg Regional Council area, are described in Table 1.
- The third element refers to the vegetation.

Each regional ecosystem is given a three-part code based on these elements. For example, Regional Ecosystem 12.1.3 is in South East Queensland, is on tidal flats and beaches, and the vegetation is mangrove shrubland to low closed forest. The regional ecosystems impacted by increased storm surge and sea-level rise are listed and described in Table 2.

No current, region wide, mapping was available for rocky headlands, seagrass, rocky and coral reefs and soft bottom habitat. The likely occurrence of each of these habitats, and of open beaches in each sub-region, was assessed from interpretation of aerial images by experienced marine ecologists. While not mapped, the sensitivity of each of these habitat types was included.

The suite of habitat types in each sub-region that may be impacted by the storm tide 1% AEP associated with an 80 cm increase in sea level rise (SLR) are listed in Table 3. These habitats are briefly described in Table 2 and are based on descriptions in Queensland Herbarium 2019.

Environmental Consequences

The environmental consequences were assessed with respect to impacts to habitats listed as threatened at a State level (regional ecosystem listed as threatened), Commonwealth level (EPBC listed threatened community), and to the assessment of habitat values in Phase 4.

Threatened Regional Ecosystem Classifications

The Regional Ecosystem Description Database (REDD) lists the vegetation management class (VM class) and the biodiversity status (BD Status) of each regional ecosystem, listed in the fourth and fifth column of Table 2

The biodiversity status is based on an assessment of the condition of remnant vegetation in addition to the criteria used to determine the class under the *Vegetation Management Act 1999* (VMA) (Queensland Government 2017).

VM Classes

A regional ecosystem is listed as ‘endangered’ under the VMA if:

- remnant vegetation is less than 10% of its pre-clearing extent across the bioregion; or
- 10–30% of its pre-clearing extent remains and the remnant vegetation is less than 10,000 ha.

A regional ecosystem is listed as ‘of concern’ under the VMA if:

- remnant vegetation is 10–30% of its pre-clearing extent across the bioregion; or
- more than 30% of its pre-clearing extent remains and the remnant extent is less than 10,000 ha.

A regional ecosystem is listed as ‘least concern’ under the VMA if:

- remnant vegetation is over 30% of its pre-clearing extent across the bioregion, and the remnant area is greater than 10,000 ha.

Biodiversity Status

A regional ecosystem is listed with a biodiversity status of ‘endangered’ if:

- less than 10% of its pre-clearing extent remains unaffected by severe degradation and/or biodiversity loss1, or
- 10–30% of its pre-clearing extent remains unaffected by severe degradation and/or biodiversity loss and the remnant vegetation is less than 10,000ha, or
- it is a rare regional ecosystem subject to a threatening process.

A regional ecosystem is listed with a biodiversity status 'of concern' if:

- 10–30% of its pre-clearing extent remains unaffected by moderate degradation and/or biodiversity loss.

A regional ecosystem is listed with a biodiversity status of ‘no concern at present’ if:

- the degradation criteria listed above for ‘endangered’ or ‘of concern’ regional ecosystems are not met.

EPBC Act Listed Threatened Communities.

Threatened communities are also declared at a Commonwealth level, listed in the last column of Table 2

Table 1 Descriptions of the land zones that regional ecosystems are on in the Bundaberg Regional Council Area that would be impacted by increased storm tides and sea level rise.

Land Zone	Short Description	Long Description
1	Tidal flats and beaches	Quaternary estuarine and marine deposits subject to periodic inundation by marine waters. Includes mangroves, saltpans, offshore tidal flats and tidal beaches. Soils are predominantly Hydrosols (saline muds, clays and sands) or beach sand.
2	Coastal dunes	Quaternary coastal dunes and beach ridges. Includes degraded dunes, sand plains and swales, lakes and swamps enclosed by dunes, as well as coral and sand cays. Soils are predominantly Rudosols and Tenosols (siliceous or calcareous sands), Podosols and Organosols.
3	Alluvial river and creek flats	Recent Quaternary alluvial systems, including closed depressions, paleo-estuarine deposits currently under freshwater influence, inland lakes and associated wave-built lunettes. Excludes colluvial deposits such as talus slopes and pediments. Includes a diverse range of soils, predominantly Vertosols and Sodosols; also, with Dermosols, Kurosols, Chromosols, Kandosols, Tenosols, Rudosols and Hydrosols; and Organosols in high rainfall areas.
5	Old loamy and sandy plains	Tertiary-early Quaternary extensive, uniform near level or gently undulating plains with sandy or loamy soils. Includes dissected remnants of these surfaces. Also includes plains with sandy or loamy soils of uncertain origin, and plateau remnants with moderate to deep soils usually overlying duricrust. Excludes recent Quaternary alluvial systems (land zone 3), exposed duricrust (land zone 7), and soils derived from underlying bedrock (land zones 8 to 12). Soils are usually Tenosols and Kandosols, also minor deep sandy surfaced Sodosols and Chromosols. There may be a duricrust at depth.
8	Basalt plains and hills	Cainozoic igneous rocks, predominantly flood basalts forming extensive plains and occasional low scarps. Also includes hills, cones and plugs on trachytes and rhyolites, and associated interbedded sediments, and talus. Excludes deep soils overlying duricrust (land zone 5). Soils include Vertosols, Ferrosols, and shallow Dermosols.
11	Hills and lowlands on metamorphic rocks	Metamorphosed rocks, forming ranges, hills and lowlands. Primarily lower Permian and older sedimentary formations which are generally moderately to strongly deformed. Includes low- to high-grade and contact metamorphics such as phyllites, slates, gneisses of indeterminate origin and serpentinite, and interbedded volcanics. Soils are mainly shallow, gravelly Rudosols and Tenosols, with Sodosols and Chromosols on lower slopes and gently undulating areas. Soils are typically of low to moderate fertility.

Table 2 Descriptions and conservation status of regional ecosystems and other habitats that will be disturbed by increased storm tides and sea-level rise.

Habitat	Land Zone	Description	VM Class[3]	Biodiversity Status[4]	EPBC Act Status
Estuary	NA	Tidally inundated estuary	NA	NA	NA
Small inlet	NA	As per RE mapping	NA	NA	NA
Beach	NA	Open sandy beach / sea turtle sensitive area	NA	NA	NA
Rocky and coral reefs	NA	Intertidal and subtidal headlands, rocky shorelines and shelfs, subtidal rocky reefs and outcrops, intertidal pools and coral reefs. Each of these supports a range of species adapted to the rocky environment including reef species and intertidal organisms.	NA	NA	NA
Seagrass	NA	Intertidal and subtidal seagrass meadows present.	NA	NA	NA
Soft bottom habitat	NA	Unvegetated soft sediment habitat	NA	NA	NA
12.1.1	Tidal flats and beaches	Casuarina glauca woodland on margins of marine clay plains. Infrequently tidally inundated. This RE occupies a very small niche at the upper end of the tidal zone.	Of concern	Of concern	Endangered
12.1.2	Tidal flats and beaches	Saltpan vegetation including grassland, herbland and sedgeland on marine clay plains. Usually occurs on hypersaline Quaternary estuarine deposits. Tidally inundated less frequently than mangroves. This ecosystem is under threat from sea level rise along its seaward margins	Least concern	No concern at present	Vulnerable
12.1.3	Tidal flats and beaches	Mangrove shrubland to low closed forest on marine clay plains and estuaries	Least concern	No concern at present	

[3] Status according to the Vegetation Management Act (VMA)
[4] Biodiversity status

12.2.2	Coastal dunes	Microphyll/notophyll vine forest on beach ridges. Continues to be threatened by clearing for coastal residential development.	Of concern	Endangered	Critically Endangered
12.2.7	Coastal dunes	Melaleuca quinquenervia or rarely M. dealbata open forest on sand plains	Least concern	No concern at present	
12.2.9	Coastal dunes	Banksia aemula low open woodland on dunes and sand plains. Usually deeply leached soils. Extensively cleared for urban development.	Least concern	No concern at present	
12.2.11	Coastal dunes	Corymbia tessellaris +/- Eucalyptus tereticornis, C. intermedia and Livistona decora woodland on beach ridges in northern half of bioregion. Contains palustrine wetland (e.g. in swales).	Least concern	No concern at present	
12.2.12	Coastal dunes	Closed heath on seasonally waterlogged sand plains. Palustrine wetland (e.g. vegetated swamp).	Of concern	Of concern	
12.2.14	Coastal dunes	Foredune complex. Strand and fore dune complex comprising Spinifex sericeus grassland Casuarina equisetifolia subsp. incana low woodland/open forest and with Acacia leiocalyx, A. disparrima subsp. disparrima, Banksia integrifolia subsp. integrifolia, Pandanus tectorius, Corymbia tessellaris, Cupaniopsis anacardioides, Acronychia imperforata. Occurs mostly on frontal dunes and beaches but can occur on exposed parts of dunes further inland.	Least concern	No concern at present	
12.2.15	Coastal dunes	Gahnia sieberiana, Empodisma minus, Gleichenia spp. closed sedgeland in coastal swamps. Palustrine wetland (e.g. vegetated swamp).	Least concern	No concern at present	
12.2.15a	Coastal dunes	Permanent and semi-permanent window lakes. Occurs as a window into the water table on Quaternary coastal dunes and beaches. Low part of coastal landscape where water collects from both overland flow and infiltration from adjoining sand dunes. Lacustrine wetland (e.g. lake).	Least concern	No concern at present	

12.3.3	Alluvial river and creek flats	Eucalyptus tereticornis woodland on Quaternary alluvium. Floodplain (other than floodplain wetlands).	Endangered	Endangered
12.3.5	Alluvial river and creek flats	Melaleuca quinquenervia open forest on coastal alluvium. Palustrine wetland (e.g. vegetated swamp).	Least concern	No concern at present
12.3.6	Alluvial river and creek flats	Melaleuca quinquenervia +/- Eucalyptus tereticornis, Lophostemon suaveolens, Corymbia intermedia open forest on coastal alluvial plains	Least concern	No concern at present
12.3.7	Alluvial river and creek flats	Eucalyptus tereticornis, Casuarina cunninghamiana subsp. cunninghamiana +/- Melaleuca spp. fringing woodland. Palustrine wetland (e.g. vegetated swamp). Riverine wetland or fringing riverine wetland.	Least concern	Of concern
12.3.7b	Alluvial river and creek flats	Naturally occurring instream waterholes and lagoons, both permanent and intermittent. Includes exposed stream bed and bars. Occurs in the bed of active (may be intermittent) river channels. Riverine wetland or fringing riverine wetland.	Least concern	Of concern
12.3.7c	Alluvial river and creek flats	Billabongs and ox-bow lakes containing either permanent or periodic water bodies. Often fringed with Eucalyptus tereticornis Old riverbeds now cut off from regular flow. Palustrine wetland (e.g. vegetated swamp).	Least concern	Of concern
12.3.11	Alluvial river and creek flats	Eucalyptus tereticornis +/- Eucalyptus siderophloia, Corymbia intermedia open forest on alluvial plains usually near coast. Contains palustrine wetland (e.g. in swales).	Of concern	Of concern
12.3.12	Alluvial river and creek flats	Eucalyptus latisinensis or E. exserta, Melaleuca viridiflora var. viridiflora woodland on alluvial plains. Contains palustrine wetland (e.g. in swales).	Least concern	No concern at present
12.3.13	Alluvial river and creek flats	Closed heathland on seasonally waterlogged alluvial plains usually near coast. Palustrine wetland (e.g. vegetated swamp). Generally, a palustrine wetland	Least concern	No concern at present

		although in cane growing areas near Bundaberg some have been converted to lacustrine water bodies associated with the construction of bunding and levees.			
12.3.14	Alluvial river and creek flats	Banksia aemula low woodland on alluvial plains usually near coast	Of concern	Of concern	
12.3.17	Alluvial river and creek flats	Simple notophyll fringing forest usually dominated by Waterhousea floribunda. Riverine wetland or fringing riverine wetland. Extensively cleared for agriculture.	Of concern	Endangered	
12.3.20	Alluvial river and creek flats	Melaleuca quinquenervia, Casuarina glauca +/- Eucalyptus tereticornis, E. siderophloia open forest on low coastal alluvial plains. Palustrine wetland (e.g. vegetated swamp).	Endangered	Endangered	Endangered[5]
12.5.2a	Old loamy and sandy plains	12.5.2a: Corymbia intermedia, Eucalyptus tereticornis woodland. Other species can include Lophostemon suaveolens, Angophora leiocarpa, Eucalyptus acmenoides or E. portuensis, E. siderophloia or E. crebra, Corymbia tessellaris and Melaleuca quinquenervia (lower slopes). Eucalyptus exserta is usually present in northern parts of bioregion. Occurs on complex of remnant Tertiary surfaces +/- Cainozoic and Mesozoic sediments usually in coastal areas with deep red soils. (BVG1M: 9g). Has been extensively cleared for horticulture, sugar cane and urban development.	Endangered	Endangered	
12.5.4	Old loamy and sandy plains	Eucalyptus latisinensis +/- Corymbia intermedia, C. trachyphloia subsp. trachyphloia, Angophora leiocarpa, Eucalyptus exserta woodland on complex of remnant Tertiary surfaces and Cainozoic and Mesozoic sediments. Has been extensively cleared and fragmented for exotic pine plantation, sugar cane and rural residential development.	Least concern	No concern at present	

[5] To confirm

12.5.5	Old loamy and sandy plains	Eucalyptus portuensis, Corymbia intermedia open forest on remnant Tertiary surfaces. Usually deep red soils	Of concern	Of concern
12.5.7	Old loamy and sandy plains	Corymbia citriodora subsp. variegata +/- Eucalyptus portuensis or E. acmenoides, E. fibrosa subsp. fibrosa open forest on remnant Tertiary surfaces. Usually deep red soils	Least concern	No concern at present
12.5.8	Old loamy and sandy plains	Eucalyptus hallii open woodland on complex of remnant Tertiary surface and Tertiary sedimentary rocks. Being cleared for sugar cane expansion and residential development. Restricted to the Burrum River-Bundaberg area.	Of concern	Of concern
12.5.10	Old loamy and sandy plains	Eucalyptus latisinensis and/or Banksia aemula low open woodland on complex of remnant Tertiary surface and Tertiary sedimentary rocks	Least concern	No concern at present
12.8.13	Basalt plains and hills	Araucarian complex microphyll vine forest on Cainozoic igneous rocks. Cleared for agriculture. Remnants can be degraded by weed infestation in conjunction with wildfire damage on margins.	Of concern	Of concern
12.8.16	Basalt plains and hills	Eucalyptus crebra +/- E. melliodora, E. tereticornis woodland on Cainozoic igneous rocks	Of concern	Of concern
12.11.18	Hills and lowlands on metamorphic rocks	Eucalyptus moluccana woodland on metamorphics +/- interbedded volcanics. Extensively cleared and thinned for grazing and urban development.	Least concern	No concern at present

Cells shaded grey indicate threatened status of at least of concern under State or Commonwealth listings

Cells shaded orange indicate threatened status of at least endangered under State or Commonwealth listings

Table 3 Habitat types in each sub-region that would be impacted by the storm tide 1% AEP associated with an 80 cm increase in sea-level rise.

Habitat Type / Regional Ecosystem	Bargara	Burnett Heads	Buxton	Coonarr	Elliot Heads	Innes Park and Coral Cove	Miara and Norval Park	Moore Park Beach	Woodgate
Estuary	✓	✓	✓	✓	✓	✓	✓	✓	✓
Small inlet	✓		✓	✓	✓		✓	✓	
Beach	✓	✓		✓	✓	✓	✓	✓	✓
Rocky and coral reefs	✓	✓		✓	✓	✓	✓		✓
Seagrass	✓	✓	✓		✓	✓	✓		✓
Soft bottom habitat	✓	✓	✓	✓	✓	✓	✓	✓	✓
12.1.1		✓		✓	✓		✓	✓	✓
12.1.2	✓	✓	✓	✓	✓		✓	✓	✓
12.1.3	✓	✓	✓	✓	✓	✓	✓	✓	✓
12.2.2				✓			✓	✓	
12.2.7		✓		✓			✓	✓	✓
12.2.9				✓			✓		✓
12.2.11	✓	✓	✓	✓	✓	✓	✓	✓	✓
12.2.12				✓			✓		✓
12.2.14		✓		✓			✓	✓	✓
12.2.15				✓			✓		✓
12.2.15a							✓		
12.3.3		✓			✓		✓	✓	

12.3.5		✓	✓	✓	✓	✓		✓
12.3.6		✓		✓		✓		✓
12.3.7	✓	✓		✓		✓		✓
12.3.7b	✓	✓				✓		✓
12.3.7c						✓		
12.3.11	✓	✓	✓	✓				✓
12.3.12	✓	✓						✓
12.3.13		✓	✓				✓	✓
12.3.14								✓
12.3.17	✓					✓	✓	
12.3.20	✓							
12.5.2a			✓			✓		
12.5.4		✓	✓	✓		✓	✓	
12.5.5						✓		
12.5.7						✓		
12.5.8	✓	✓						
12.5.10			✓	✓				✓
12.8.13	✓							
12.8.16				✓	✓			
12.11.18						✓		

Habitat and Ecosystem Sensitivity

Habitat and Ecosystem sensitivity scores were assessed qualitatively for each habitat for a sea-level rise of 80 cm SLR by 2100, and the associated storm tide 1% AEP. An sensitivity ranking is included in Table . A qualitative assessment of a habitat's ability to withstand increased salinity and inundation according to Table was used to derive a preliminary sensitivity metric, Table .

Table 4 Ecosystem and Habitat sensitivity ranking

1	No sensitivity to damage or no time required for recovery
2	Limited sensitivity to damage or short time for recovery
3	Moderate sensitivity to damage or time for recovery
4	Highly sensitive to damage or long time for recovery
5	Critically sensitive to damage or very long time for recovery

Sensitivity scores are presented in the attached excel spreadsheet for each habitat type.

Ecosystem Recovery / Adaptive Capacity

The adaptive capacity of each habitat type was qualitatively assessed. The description of the ranking is listed in Table .

Table 5 Adaptive capacity ranking

1	Very Low
2	Low
3	Moderate
4	High
5	Very High

Ecosystem Recovery / adaptive capacity scores were ranked according to Table , and derived from a qualitative assessment of:

- The dispersive capacity and likely growth rates of plant and sessile benthic fauna species in the habitat (i.e. a component of its adaptive capacity).
- Whether the land zone could migrate in the likely time frames (i.e. a component of its adaptive capacity).

Ecosystem Recovery / adaptive capacity was modified for each subregion according to whether there was habitat available for the habitat to migrate in to. The ranking was then modified by adding a separate score regarding ability of land zone to migrate inland. The habitat type or ecosystem score were then added together and divided by two in order to derive a mean score for each habitat. This mean score is listed in the last column of Table .

Final adaptive capacity scores are presented in the vulnerability assessment results tables.

Final ecosystem recovery scores are presented in the consequence assessment results tables.

Table 6 Preliminary sensitivity and recovery metrics for regional ecosystems and other habitats that will be disturbed by increased storm tides and sea level rise.

Habitat	Land Zone	Description	Sensitivity Comments	Ecosystem Sensitivity Score	Dispersive Capacity and Likely Growth Rates	Ability of Land Zone to Migrate Inland	Adaptive Capacity / Ecosystem Recovery
					A	**B**	**(A+B)/2**
Estuary	NA	Tidally inundated estuary	Tolerant of increased saline inundation	2	5	5	5
Small inlet	NA	As per RE mapping	Tolerant of increased saline inundation	2	5	5	5
Beach	NA	Open sandy beach / sea turtle sensitive area	Not tolerant of increased depth	4	5	3	4
Rocky and coral reefs	NA	Intertidal and subtidal headlands, rocky shorelines and shelfs, subtidal rocky reefs and outcrops, intertidal pools and coral reefs.	Some tolerance of increased depth	2	1	1	1
Seagrass	NA	Intertidal and subtidal seagrass meadows present.	Some tolerance of increased depth	3	4	3	3
Soft bottom habitat	NA	Unvegetated soft sediment habitat	Some tolerance of increased depth	3	5	4	4
12.1.1	Tidal flats and beaches	Casuarina glauca woodland on margins of marine clay plains. Infrequently tidally inundated. This RE occupies a very small niche at upper end of tidal zone.	Not tolerant of increased salinity	4	2	4	3
12.1.2	Tidal flats and beaches	Saltpan vegetation including grassland, herbland and sedgeland on marine clay plains. Usually occurs on hypersaline Quaternary estuarine deposits. Tidally inundated less frequently than mangroves. This ecosystem is under threat from sea level rise along its seaward margins	Tolerant of increased salinity, tolerant of increased depth	3	2	4	3
12.1.3	Tidal flats and beaches	Mangrove shrubland to low closed forest on marine clay plains and estuaries	Not tolerant of increased depth	4	4	4	4

Habitat	Land Zone	Description	Sensitivity Comments	Ecosystem Sensitivity Score	Dispersive Capacity and Likely Growth Rates	Ability of Land Zone to Migrate Inland	Adaptive Capacity / Ecosystem Recovery
12.2.2	Coastal dunes	Microphyll/notophyll vine forest on beach ridges. Continues to be threatened by clearing for coastal residential development.	Not tolerant of increased depth or salinity	5	2	2	2.
12.2.7	Coastal dunes	Melaleuca quinquenervia or rarely M. dealbata open forest on sand plains	Not tolerant of increased depth or salinity	5	2	2	2
12.2.9	Coastal dunes	Banksia aemula low open woodland on dunes and sand plains. Usually deeply leached soils. Extensively cleared for urban development.	Not tolerant of increased depth or salinity	5	2	2	2
12.2.11	Coastal dunes	Corymbia tessellaris +/- Eucalyptus tereticornis, C. intermedia and Livistona decora woodland on beach ridges in northern half of bioregion. Contains palustrine wetland (e.g. in swales).	Not tolerant of increased depth or salinity	5	2	2	2
12.2.12	Coastal dunes	Closed heath on seasonally waterlogged sand plains. Palustrine wetland (e.g. vegetated swamp).	Not tolerant of increased depth or salinity	5	2	2	2
12.2.14	Coastal dunes	Foredune complex. Strand and fore dune complex comprising Spinifex sericeus grassland Casuarina equisetifolia subsp. incana low woodland/open forest and with Acacia leiocalyx, A. disparrima subsp. disparrima, Banksia integrifolia subsp. integrifolia, Pandanus tectorius, Corymbia tessellaris, Cupaniopsis anacardioides, Acronychia imperforata. Occurs mostly on frontal dunes and beaches but can occur on exposed parts of dunes further inland.	Not tolerant of increased depth	5	4	2	3
12.2.15	Coastal dunes	Gahnia sieberiana, Empodisma minus, Gleichenia spp. closed sedgeland in coastal swamps. Palustrine wetland (e.g. vegetated swamp).	Not tolerant of increased depth or salinity	5	4	2	3
12.2.15a	Coastal dunes	Permanent and semi-permanent window lakes. Occurs as a window into the water table on Quaternary coastal dunes and beaches. Low part of coastal landscape where water collects from both overland flow and infiltration from adjoining sand dunes. Lacustrine wetland (e.g. lake).	Not tolerant of increased salinity		2	2	2

Habitat	Land Zone	Description	Sensitivity Comments	Ecosystem Sensitivity Score	Dispersive Capacity and Likely Growth Rates	Ability of Land Zone to Migrate Inland	Adaptive Capacity / Ecosystem Recovery
12.3.3	Alluvial river and creek flats	Eucalyptus tereticornis woodland on Quaternary alluvium. Floodplain (other than floodplain wetlands).	Not tolerant of increased depth or salinity	5	2	3	3
12.3.5	Alluvial river and creek flats	Melaleuca quinquenervia open forest on coastal alluvium. Palustrine wetland (e.g. vegetated swamp).	Not tolerant of increased depth or salinity	5	3	3	3
12.3.6	Alluvial river and creek flats	Melaleuca quinquenervia +/- Eucalyptus tereticornis, Lophostemon suaveolens, Corymbia intermedia open forest on coastal alluvial plains	Not tolerant of increased depth or salinity	5	3	3	3
12.3.7	Alluvial river and creek flats	Eucalyptus tereticornis, Casuarina cunninghamiana subsp. cunninghamiana +/- Melaleuca spp. fringing woodland. Palustrine wetland (e.g. vegetated swamp). Riverine wetland or fringing riverine wetland.	Not tolerant of increased depth or salinity	5	3	3	3
12.3.7b	Alluvial river and creek flats	Naturally occurring instream waterholes and lagoons, both permanent and intermittent. Includes exposed stream bed and bars. Occurs in the bed of active (may be intermittent) river channels. Riverine wetland or fringing riverine wetland.	Not tolerant of increased depth or salinity	5	3	3	3
12.3.7c	Alluvial river and creek flats	Billabongs and ox-bow lakes containing either permanent or periodic water bodies. Often fringed with Eucalyptus tereticornis Old river beds now cut off from regular flow.	Not tolerant of increased depth or salinity	5	3	3	3
12.3.11	Alluvial river and creek flats	Eucalyptus tereticornis +/- Eucalyptus siderophloia, Corymbia intermedia open forest on alluvial plains usually near coast.	Not tolerant of increased depth or salinity	5	3	3	3
12.3.12	Alluvial river and creek flats	Eucalyptus latisinensis or E. exserta, Melaleuca viridiflora var. viridiflora woodland on alluvial plains.	Not tolerant of increased depth or salinity	5	3	3	3
12.3.13	Alluvial river and creek flats	Closed heathland on seasonally waterlogged alluvial plains usually near coast. Palustrine wetland (e.g. vegetated swamp).	Not tolerant of increased depth or salinity	5	3	3	3
12.3.14	Alluvial river and creek flats	Banksia aemula low woodland on alluvial plains usually near coast	Not tolerant of increased depth or salinity	5	3	3	3

Habitat	Land Zone	Description	Sensitivity Comments	Ecosystem Sensitivity Score	Dispersive Capacity and Likely Growth Rates	Ability of Land Zone to Migrate Inland	Adaptive Capacity / Ecosystem Recovery
12.3.17	Alluvial river and creek flats	Simple notophyll fringing forest usually dominated by Waterhousea floribunda. Riverine wetland or fringing riverine wetland.	Not tolerant of increased depth or salinity	5	3	3	3
12.3.20	Alluvial river and creek flats	Melaleuca quinquenervia, Casuarina glauca +/- Eucalyptus tereticornis, E. siderophloia open forest on low coastal alluvial plains. Palustrine wetland (e.g. vegetated swamp).	Not tolerant of increased depth or salinity	5	3	3	3
12.5.2a	Old loamy and sandy plains	12.5.2a: Corymbia intermedia, Eucalyptus tereticornis woodland. Other species can include Lophostemon suaveolens, Angophora leiocarpa, Eucalyptus acmenoides or E. portuensis, E. siderophloia or E. crebra, Corymbia tessellaris and Melaleuca quinquenervia (lower slopes). Eucalyptus exserta is usually present in northern parts of bioregion. Occurs on complex of remnant Tertiary surfaces +/- Cainozoic and Mesozoic sediments usually in coastal areas with deep red soils.	Not tolerant of increased depth or salinity	5	3	2	2
12.5.4	Old loamy and sandy plains	Eucalyptus latisinensis +/- Corymbia intermedia, C. trachyphloia subsp. trachyphloia, Angophora leiocarpa, Eucalyptus exserta woodland on complex of remnant Tertiary surfaces and Cainozoic and Mesozoic sediments.	Not tolerant of increased depth or salinity	5	3	2	2
12.5.5	Old loamy and sandy plains	Eucalyptus portuensis, Corymbia intermedia open forest on remnant Tertiary surfaces.	Not tolerant of increased depth or salinity	5	3	2	2
12.5.7	Old loamy and sandy plains	Corymbia citriodora subsp. variegata +/- Eucalyptus portuensis or E. acmenoides, E. fibrosa subsp. fibrosa open forest on remnant Tertiary surfaces.	Not tolerant of increased depth or salinity	5	3	2	2
12.5.8	Old loamy and sandy plains	Eucalyptus hallii open woodland on complex of remnant Tertiary surface and Tertiary sedimentary rocks.	Not tolerant of increased depth or salinity	5	3	2	2
12.5.10	Old loamy and sandy plains	Eucalyptus latisinensis and/or Banksia aemula low open woodland on complex of remnant Tertiary surface and Tertiary sedimentary rocks	Not tolerant of increased depth or salinity	5	3	2	2

Habitat	Land Zone	Description	Sensitivity Comments	Ecosystem Sensitivity Score	Dispersive Capacity and Likely Growth Rates	Ability of Land Zone to Migrate Inland	Adaptive Capacity / Ecosystem Recovery
12.8.13	Basalt plains and hills	Araucarian complex microphyll vine forest on Cainozoic igneous rocks. Cleared for agriculture. Remnants can be degraded by weed infestation in conjunction with wildfire damage on margins.	Not tolerant of increased depth or salinity	5	3	1	2
12.8.16	Basalt plains and hills	Eucalyptus crebra +/- E. melliodora, E. tereticornis woodland on Cainozoic igneous rocks	Not tolerant of increased depth or salinity	5	3	1	2
12.11.18	Hills and lowlands on metamorphic rocks	Eucalyptus moluccana woodland on metamorphics +/- interbedded volcanics.	Not tolerant of increased depth or salinity	**5**	3	1	2

Assessment of Overall Environmental Consequences

The assessment criteria for environmental consequence scale per coastal settlement is listed in Table . The environmental consequences of sea-level rise and coastal hazards were assessed based on the Table criteria.

Table 7 Assessment criteria for environmental consequences

Environmental – QERMF
Permanent destruction of an ecosystem or species recognised at the Local, regional, State or national level and / or severe damage to or loss of an ecosystem or species recognised at the State and national level and / or significant loss or impairment of an ecosystem or species recognised at the national level. Permanent destruction of environmental values of interest. Consequence rating > 160
Minor damage to ecosystems or species recognised at the national level and / or significant loss or impairment of an ecosystem or species recognised at the State level and / or severe damage to or loss of an ecosystem or species recognised at the Local or regional level. Severe damage to environmental values of interest. Consequence rating between 120 and 160
Minor damage to ecosystems and species recognised at the State level and / or significant loss or impairment of an ecosystem or species recognised at the Local or regional level. Significant damage to environmental values of interest. Consequence rating between 80 and 120
Minor damage to ecosystems and species recognised at the Local or regional level. Minor damage to environmental values of interest. Consequence rating between 40 and 80

References

Queensland Government 2016. Regional Ecosystem Framework. https://www.qld.gov.au/environment/plants-animals/plants/ecosystems/descriptions/framework. Accessed June 2019.

Queensland Government 2017. Biodiversity status and vegetation management class https://www.qld.gov.au/environment/plants-animals/plants/ecosystems/descriptions/biodiversity-status. Accessed June 2019.

Queensland Herbarium 2019. Regional Ecosystem Description Database (REDD). Version 11.1 (April 2019) (Queensland Department of Environment and Science: Brisbane).

Sattler and Williams 1999

RISK ANALYSIS – ENVIRONMENTAL CONSEQUENCE

Methodology

The impacts to coastal ecosystems of significant ecological, conservational or biodiversity value were assessed by proportioning the range and scale of the ecosystem types impacted combined with the ability of ecosystem to recover and the sensitivity of the ecosystem to a range of different likelihood coastal hazard events and sea level scenarios. As the vulnerability assessment exercise provided an index-based measure of the environmental value and sensitivity of the coastal ecosystems to different hazard types, risk was also assessed using an index-based approach.

The scale of the rating scores are shown in Table 1 and Table 2. Each score is then accumulated for each coastal settlement and assigned a value which is evaluated within the consequence scale within Table 3.

TABLE 1 ECOSYSTEM SENSITIVITY RATING

Ecosystem Sensitivity	Score
No sensitivity to damage or no time required for recovery	1
Limited sensitivity to damage or short time for recovery	2
Moderate sensitivity to damage or time for recovery	3
Highly sensitive to damage or long time for recovery	4
Critically sensitive to damage or very long time for recovery	5

TABLE 2 ECOSYSTEM RECOVERY RATING

Capacity of ecosystem to fully recover	Score
Very Low	1
Low	2
Moderate	3
High	4
Very High	5

TABLE 3 ENVIRONMENTAL CONSEQUENCE SCALE

Environmental Consequence	Calculated Score
Catastrophic	160+
Major	120-160
Moderate	80-120
Minor	40-80
Insignificant	0-40

Environmental consequence assessment results

Each table provides environmental index-based qualitative assessment of ecosystem recovery and sensitivity to a range of likelihood events and sea level rise scenarios.

MIARA & NORVAL PARK

	CURRENT SEA LEVEL								
		5% AEP		2% AEP		1% AEP		0.2% AEP	
Environmental Asset	Ecosystem Recovery Rating	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE
Estuary	2	1	2	1	2	2	4	3	6
Small Inlet	2	1	2	1	2	2	4	3	6
Beach	1	2	2	3	3	4	4	5	5
Rocky and Coral Reefs	1	1	1	1	1	2	2	3	3
Seagrass	1	1	1	2	2	3	3	4	4
Soft Bottom Habitat	1	1	1	2	2	3	3	4	4
12.1.1 Tidal flats and beaches Casuarina glauca	1	2	2	3	3	4	4	5	5
12.2.2 Coastal dunes Microphyll/notophyll vine forest	1	3	3	4	4	5	5	5	5
12.2.12 Coastal dunes Closed heath	1	3	3	4	4	5	5	5	5
12.3.3 Alluvial river and creek flats Eucalyptus tereticornis woodland	1	3	3	4	4	5	5	5	5
12.3.7 Alluvial river and creek flats Eucalyptus tereticornis	1	3	3	4	4	5	5	5	5
12.3.7b Alluvial river and creek flats Naturally occurring instream waterholes and lagoons	1	3	3	4	4	5	5	5	5
12.3.7c Alluvial river and creek flats Billabongs and ox-bow lakes	1	3	3	4	4	5	5	5	5
12.3.17 Alluvial river and creek flats Simple notophyll fringing forest	1	3	3	4	4	5	5	5	5
12.5.2a Old loamy and sandy plains Corymbia intermediate	1	3	3	4	4	5	5	5	5
	TOTAL		35		47		64		73
	CONSEQUENCE		Insignificant		Insignificant		Minor		Minor

	0.2M SEA LEVEL RISE								
		5% AEP		2% AEP		1% AEP		0.2% AEP	
Environmental Asset	Ecosystem Recovery Rating	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE
Estuary	3	1	3	1	3	2	6	3	9
Small Inlet	3	1	3	1	3	2	6	3	9
Beach	2	2	4	3	6	4	8	5	10
Rocky and Coral Reefs	1	1	1	1	1	2	2	3	3
Seagrass	1	1	1	2	2	3	3	4	4
Soft Bottom Habitat	2	1	2	2	4	3	6	4	8
12.1.1 Tidal flats and beaches Casuarina glauca	1	2	2	3	3	4	4	5	5
12.2.2 Coastal dunes Microphyll/notophyll vine forest	1	3	3	4	4	5	5	5	5
12.2.12 Coastal dunes Closed heath	1	3	3	4	4	5	5	5	5
12.3.3 Alluvial river and creek flats Eucalyptus tereticornis woodland	1	3	3	4	4	5	5	5	5
12.3.7 Alluvial river and creek flats Eucalyptus tereticornis	1	3	3	4	4	5	5	5	5
12.3.7b Alluvial river and creek flats Naturally occurring instream waterholes and lagoons	1	3	3	4	4	5	5	5	5
12.3.7c Alluvial river and creek flats Billabongs and ox-bow lakes	1	3	3	4	4	5	5	5	5
12.3.17 Alluvial river and creek flats Simple notophyll fringing forest	1	3	3	4	4	5	5	5	5
12.5.2a Old loamy and sandy plains Corymbia intermediate	1	3	3	4	4	5	5	5	5
	TOTAL		40		54		75		88
	CONSEQUENCE		Insignificant		Insignificant		Minor		Minor

		0.4M SEA LEVEL RISE							
		5% AEP		2% AEP		1% AEP		0.2% AEP	
Environmental Asset	Ecosystem Recovery Rating	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE
Estuary	4	1	4	1	4	2	8	3	12
Small Inlet	4	1	4	1	4	2	8	3	12
Beach	3	2	6	3	9	4	12	5	15
Rocky and Coral Reefs	1	1	1	1	1	2	2	3	3
Seagrass	2	1	2	2	4	3	6	4	8
Soft Bottom Habitat	3	1	3	2	6	3	9	4	12
12.1.1 Tidal flats and beaches Casuarina glauca	2	2	4	3	6	4	8	5	10
12.2.2 Coastal dunes Microphyll/notophyll vine forest	1	3	3	4	4	5	5	5	5
12.2.12 Coastal dunes Closed heath	1	3	3	4	4	5	5	5	5
12.3.3 Alluvial river and creek flats Eucalyptus tereticornis woodland	2	3	6	4	8	5	10	5	10
12.3.7 Alluvial river and creek flats Eucalyptus tereticornis	2	3	6	4	8	5	10	5	10
12.3.7b Alluvial river and creek flats Naturally occurring instream waterholes and lagoons	2	3	6	4	8	5	10	5	10
12.3.7c Alluvial river and creek flats Billabongs and ox-bow lakes	2	3	6	4	8	5	10	5	10
12.3.17 Alluvial river and creek flats Simple notophyll fringing forest	2	3	6	4	8	5	10	5	10
12.5.2a Old loamy and sandy plains Corymbia intermediate	1	3	3	4	4	5	5	5	5
	TOTAL		63		86		118		137
	CONSEQUENCE		Minor		Minor		Moderate		Moderate

		0.8M SEA LEVEL RISE							
		5% AEP		2% AEP		1% AEP		0.2% AEP	
Environmental Asset	Ecosystem Recovery Rating	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE
Estuary	5	1	5	1	5	2	10	3	15
Small Inlet	5	1	5	1	5	2	10	3	15
Beach	4	2	8	3	12	4	16	5	20
Rocky and Coral Reefs	1	1	1	1	1	2	2	3	3
Seagrass	3	1	3	2	6	3	9	4	12
Soft Bottom Habitat	4	1	4	2	8	3	12	4	16
12.1.1 Tidal flats and beaches Casuarina glauca	3	2	6	3	9	4	12	5	15
12.2.2 Coastal dunes Microphyll/notophyll vine forest	2	3	6	4	8	5	10	5	10
12.2.12 Coastal dunes Closed heath	2	3	6	4	8	5	10	5	10
12.3.3 Alluvial river and creek flats Eucalyptus tereticornis woodland	3	3	9	4	12	5	15	5	15
12.3.7 Alluvial river and creek flats Eucalyptus tereticornis	3	3	9	4	12	5	15	5	15
12.3.7b Alluvial river and creek flats Naturally occurring instream waterholes and lagoons	3	3	9	4	12	5	15	5	15
12.3.7c Alluvial river and creek flats Billabongs and ox-bow lakes	3	3	9	4	12	5	15	5	15
12.3.17 Alluvial river and creek flats Simple notophyll fringing forest	3	3	9	4	12	5	15	5	15
12.5.2a Old loamy and sandy plains Corymbia intermediate	2	3	6	4	8	5	10	5	10
	TOTAL		95		130		176		201
	CONSEQUENCE		Minor		Moderate		Major		Major

MOORE PARK BEACH

	CURRENT SEA LEVEL								
		5% AEP		2% AEP		1% AEP		0.2% AEP	
Environmental Asset	Ecosystem Recovery Rating	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE
Estuary	2	1	2	1	2	2	4	3	6
Small Inlet	2	1	2	1	2	2	4	3	6
Beach	1	2	2	3	3	4	4	5	5
Soft Bottom Habitat	1	1	1	2	2	3	3	4	4
12.1.1 Tidal flats and beaches Casuarina glauca	1	2	2	3	3	4	4	5	5
12.2.2 Coastal dunes Microphyll/notophyll vine forest	1	3	3	4	4	5	5	5	5
12.3.3 Alluvial river and creek flats Eucalyptus tereticornis woodland	1	3	3	4	4	5	5	5	5
12.3.17 Alluvial river and creek flats Simple notophyll fringing forest	1	3	3	4	4	5	5	5	5
	TOTAL		18		24		34		41
	CONSEQUENCE		Insignificant		Insignificant		Minor		Minor

	0.2M SEA LEVEL RISE								
		5% AEP		2% AEP		1% AEP		0.2% AEP	
Environmental Asset	Ecosystem Recovery Rating	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE
Estuary	3	1	3	1	3	2	6	3	9
Small Inlet	3	1	3	1	3	2	6	3	9
Beach	2	2	4	3	6	4	8	5	10
Soft Bottom Habitat	2	1	2	2	4	3	6	4	8
12.1.1 Tidal flats and beaches Casuarina glauca	1	2	2	3	3	4	4	5	5
12.2.2 Coastal dunes Microphyll/notophyll vine forest	1	3	3	4	4	5	5	5	5
12.3.3 Alluvial river and creek flats Eucalyptus tereticornis woodland	1	3	3	4	4	5	5	5	5
12.3.17 Alluvial river and creek flats Simple notophyll fringing forest	1	3	3	4	4	5	5	5	5
	TOTAL		23		31		45		56
	CONSEQUENCE		Insignificant		Insignificant		Minor		Minor

	0.4M SEA LEVEL RISE								
		5% AEP		2% AEP		1% AEP		0.2% AEP	
Environmental Asset	Ecosystem Recovery Rating	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE
Estuary	4	1	4	1	4	2	8	3	12
Small Inlet	4	1	4	1	4	2	8	3	12
Beach	3	2	6	3	9	4	12	5	15
Soft Bottom Habitat	3	1	3	2	6	3	9	4	12
12.1.1 Tidal flats and beaches Casuarina glauca	2	2	4	3	6	4	8	5	10
12.2.2 Coastal dunes Microphyll/notophyll vine forest	1	3	3	4	4	5	5	5	5
12.3.3 Alluvial river and creek flats Eucalyptus tereticornis woodland	2	3	6	4	8	5	10	5	10
12.3.17 Alluvial river and creek flats Simple notophyll fringing forest	2	3	6	4	8	5	10	5	10
	TOTAL		36		49		70		86
	CONSEQUENCE		Minor		Minor		Moderate		Moderate

	0.8M SEA LEVEL RISE								
		5% AEP		2% AEP		1% AEP		0.2% AEP	
Environmental Asset	Ecosystem Recovery Rating	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE
Estuary	5	1	5	1	5	2	10	3	15
Small Inlet	5	1	5	1	5	2	10	3	15
Beach	4	2	8	3	12	4	16	5	20
Soft Bottom Habitat	4	1	4	2	8	3	12	4	16
12.1.1 Tidal flats and beaches Casuarina glauca	3	2	6	3	9	4	12	5	15
12.2.2 Coastal dunes Microphyll/notophyll vine forest	2	3	6	4	8	5	10	5	10
12.3.3 Alluvial river and creek flats Eucalyptus tereticornis woodland	3	3	9	4	12	5	15	5	15
12.3.17 Alluvial river and creek flats Simple notophyll fringing forest	3	3	9	4	12	5	15	5	15
	TOTAL		52		71		100		121
	CONSEQUENCE		Minor		Moderate		Major		Major

BURNETT HEADS

	CURRENT SEA LEVEL								
		5% AEP		2% AEP		1% AEP		0.2% AEP	
Environmental Asset	Ecosystem Recovery Rating	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE
Estuary	2	1	2	1	2	2	4	3	6
Beach	1	2	2	3	3	4	4	5	5
Rocky and Coral Reefs	1	1	1	1	1	2	2	3	3
Seagrass	1	1	1	2	2	3	3	4	4
Soft Bottom Habitat	1	1	1	2	2	3	3	4	4
12.1.1 Tidal flats and beaches Casuarina glauca	1	2	2	3	3	4	4	5	5
12.3.3 Alluvial river and creek flats Eucalyptus tereticornis woodland	1	3	3	4	4	5	5	5	5
12.3.7 Alluvial river and creek flats Eucalyptus tereticornis	1	3	3	4	4	5	5	5	5
12.3.7b Alluvial river and creek flats Naturally occurring instream waterholes and lagoons	1	3	3	4	4	5	5	5	5
12.3.11 Alluvial river and creek flats Eucalyptus tereticornis	1	3	3	4	4	5	5	5	5
12.5.8 Old loamy and sandy plains Eucalyptus hallii open woodland	1	3	3	4	4	5	5	5	5
12.8.13 Basalt plains and hills Araucarian complex	1	3	3	4	4	5	5	5	5
	TOTAL		24		33		45		52
	CONSEQUENCE		Insignificant		Insignificant		Insignificant		Insignificant

	0.2M SEA LEVEL RISE								
		5% AEP		2% AEP		1% AEP		0.2% AEP	
Environmental Asset	Ecosystem Recovery Rating	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE
Estuary	3	1	3	1	3	2	6	3	9
Beach	2	2	4	3	6	4	8	5	10
Rocky and Coral Reefs	1	1	1	1	1	2	2	3	3
Seagrass	1	1	1	2	2	3	3	4	4
Soft Bottom Habitat	2	1	2	2	4	3	6	4	8
12.1.1 Tidal flats and beaches Casuarina glauca	1	2	2	3	3	4	4	5	5
12.3.3 Alluvial river and creek flats Eucalyptus tereticornis woodland	1	3	3	4	4	5	5	5	5
12.3.7 Alluvial river and creek flats Eucalyptus tereticornis	1	3	3	4	4	5	5	5	5
12.3.7b Alluvial river and creek flats Naturally occurring instream waterholes and lagoons	1	3	3	4	4	5	5	5	5
12.3.11 Alluvial river and creek flats Eucalyptus tereticornis	1	3	3	4	4	5	5	5	5
12.5.8 Old loamy and sandy plains Eucalyptus hallii open woodland	1	3	3	4	4	5	5	5	5
12.8.13 Basalt plains and hills Araucarian complex	1	3	3	4	4	5	5	5	5
	TOTAL		28		39		54		64
	CONSEQUENCE		Insignificant		Insignificant		Insignificant		Insignificant

	0.4M SEA LEVEL RISE								
		5% AEP		2% AEP		1% AEP		0.2% AEP	
Environmental Asset	Ecosystem Recovery Rating	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE
Estuary	4	1	4	1	4	2	8	3	12
Beach	3	2	6	3	9	4	12	5	15
Rocky and Coral Reefs	1	1	1	1	1	2	2	3	3
Seagrass	2	1	2	2	4	3	6	4	8
Soft Bottom Habitat	3	1	3	2	6	3	9	4	12
12.1.1 Tidal flats and beaches Casuarina glauca	2	2	4	3	6	4	8	5	10
12.3.3 Alluvial river and creek flats Eucalyptus tereticornis woodland	2	3	6	4	8	5	10	5	10
12.3.7 Alluvial river and creek flats Eucalyptus tereticornis	2	3	6	4	8	5	10	5	10
12.3.7b Alluvial river and creek flats Naturally occurring instream waterholes and lagoons	2	3	6	4	8	5	10	5	10
12.3.11 Alluvial river and creek flats Eucalyptus tereticornis	2	3	6	4	8	5	10	5	10
12.5.8 Old loamy and sandy plains Eucalyptus hallii open woodland	1	3	3	4	4	5	5	5	5
12.8.13 Basalt plains and hills Araucarian complex	1	3	3	4	4	5	5	5	5
	TOTAL		47		66		90		105
	CONSEQUENCE		Insignificant		Insignificant		Minor		Minor

	0.8M SEA LEVEL RISE								
		5% AEP		2% AEP		1% AEP		0.2% AEP	
Environmental Asset	Ecosystem Recovery Rating	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE
Estuary	5	1	5	1	5	2	10	3	15
Beach	4	2	8	3	12	4	16	5	20
Rocky and Coral Reefs	1	1	1	1	1	2	2	3	3
Seagrass	3	1	3	2	6	3	9	4	12
Soft Bottom Habitat	4	1	4	2	8	3	12	4	16
12.1.1 Tidal flats and beaches Casuarina glauca	3	2	6	3	9	4	12	5	15
12.3.3 Alluvial river and creek flats Eucalyptus tereticornis woodland	3	3	9	4	12	5	15	5	15
12.3.7 Alluvial river and creek flats Eucalyptus tereticornis	3	3	9	4	12	5	15	5	15
12.3.7b Alluvial river and creek flats Naturally occurring instream waterholes and lagoons	3	3	9	4	12	5	15	5	15
12.3.11 Alluvial river and creek flats Eucalyptus tereticornis	3	3	9	4	12	5	15	5	15
12.5.8 Old loamy and sandy plains Eucalyptus hallii open woodland	2	3	6	4	8	5	10	5	10
12.8.13 Basalt plains and hills Araucarian complex	2	3	6	4	8	5	10	5	10
	TOTAL		69		97		131		151
	CONSEQUENCE		Insignificant		Insignificant		Minor		Minor

BARGARA

	CURRENT SEA LEVEL								
		5% AEP		2% AEP		1% AEP		0.2% AEP	
Environmental Asset	Ecosystem Recovery Rating	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE
Estuary	2	1	2	1	2	2	4	3	6
Small Inlet	2	1	2	1	2	2	4	3	6
Beach	1	2	2	3	3	4	4	5	5
Rocky and Coral Reefs	1	1	1	1	1	2	2	3	3
Seagrass	1	1	1	2	2	3	3	4	4
Soft Bottom Habitat	1	1	1	2	2	3	3	4	4
	TOTAL		9		12		20		28
	CONSEQUENCE		Insignificant		Insignificant		Insignificant		Insignificant

	0.2M SEA LEVEL RISE								
		5% AEP		2% AEP		1% AEP		0.2% AEP	
Environmental Asset	Ecosystem Recovery Rating	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE
Estuary	3	1	3	1	3	2	6	3	9
Small Inlet	3	1	3	1	3	2	6	3	9
Beach	2	2	4	3	6	4	8	5	10
Rocky and Coral Reefs	1	1	1	1	1	2	2	3	3
Seagrass	1	1	1	2	2	3	3	4	4
Soft Bottom Habitat	2	1	2	2	4	3	6	4	8
	TOTAL		14		19		31		43
	CONSEQUENCE		Insignificant		Insignificant		Insignificant		Minor

	0.4M SEA LEVEL RISE								
		5% AEP		2% AEP		1% AEP		0.2% AEP	
Environmental Asset	Ecosystem Recovery Rating	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE
Estuary	4	1	4	1	4	2	8	3	12
Small Inlet	4	1	4	1	4	2	8	3	12
Beach	3	2	6	3	9	4	12	5	15
Rocky and Coral Reefs	1	1	1	1	1	2	2	3	3
Seagrass	2	1	2	2	4	3	6	4	8
Soft Bottom Habitat	3	1	3	2	6	3	9	4	12
	TOTAL		20		28		45		62
	CONSEQUENCE		Insignificant		Insignificant		Minor		Minor

	0.8M SEA LEVEL RISE								
		5% AEP		2% AEP		1% AEP		0.2% AEP	
Environmental Asset	Ecosystem Recovery Rating	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE
Estuary	5	1	5	1	5	2	10	3	15
Small Inlet	5	0	0	1	5	2	10	3	15
Beach	4	2	8	3	12	4	16	5	20
Rocky and Coral Reefs	1	1	1	1	1	2	2	3	3
Seagrass	3	1	3	2	6	3	9	4	12
Soft Bottom Habitat	4	1	4	2	8	3	12	4	16
	TOTAL		21		37		59		81
	CONSEQUENCE		Insignificant		Insignificant		Minor		Moderate

INNES PARK & CORAL COVE

	CURRENT SEA LEVEL								
		5% AEP		2% AEP		1% AEP		0.2% AEP	
Environmental Asset	Ecosystem Recovery Rating	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE
Estuary	2	1	2	1	2	2	4	3	6
Beach	1	2	2	3	3	4	4	5	5
Rocky and Coral Reefs	1	1	1	1	1	2	2	3	3
Seagrass	1	1	1	2	2	3	3	4	4
Soft Bottom Habitat	1	1	1	2	2	3	3	4	4
12.8.16 Basalt plains and hills Eucalyptus crebra	1	3	3	4	4	5	5	5	5
	TOTAL		10		14		21		27
	CONSEQUENCE		Insignificant		Insignificant		Minor		Minor

	0.2M SEA LEVEL RISE								
		5% AEP		2% AEP		1% AEP		0.2% AEP	
Environmental Asset	Ecosystem Recovery Rating	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE
Estuary	3	1	3	1	3	2	6	3	9
Beach	2	2	4	3	6	4	8	5	10
Rocky and Coral Reefs	1	1	1	1	1	2	2	3	3
Seagrass	1	1	1	2	2	3	3	4	4
Soft Bottom Habitat	2	1	2	2	4	3	6	4	8
12.8.16 Basalt plains and hills Eucalyptus crebra	1	3	3	4	4	5	5	5	5
	TOTAL		14		20		30		39
	CONSEQUENCE		Insignificant		Insignificant		Minor		Minor

	0.4M SEA LEVEL RISE								
		5% AEP		2% AEP		1% AEP		0.2% AEP	
Environmental Asset	Ecosystem Recovery Rating	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE
Estuary	4	1	4	1	4	2	8	3	12
Beach	3	2	6	3	9	4	12	5	15
Rocky and Coral Reefs	1	1	1	1	1	2	2	3	3
Seagrass	2	1	2	2	4	3	6	4	8
Soft Bottom Habitat	3	1	3	2	6	3	9	4	12
12.8.16 Basalt plains and hills Eucalyptus crebra	1	3	3	4	4	5	5	5	5
	TOTAL		19		28		42		55
	CONSEQUENCE		Insignificant		Minor		Minor		Moderate

	0.8M SEA LEVEL RISE								
		5% AEP		2% AEP		1% AEP		0.2% AEP	
Environmental Asset	Ecosystem Recovery Rating	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE
Estuary	5	1	5	1	5	2	10	3	15
Beach	4	2	8	3	12	4	16	5	20
Rocky and Coral Reefs	1	1	1	1	1	2	2	3	3
Seagrass	3	1	3	2	6	3	9	4	12
Soft Bottom Habitat	4	1	4	2	8	3	12	4	16
12.8.16 Basalt plains and hills Eucalyptus crebra	2	3	6	4	8	5	10	5	10
	TOTAL		27		40		59		76
	CONSEQUENCE		Minor		Minor		Moderate		Major

ELLIOTT HEADS

	CURRENT SEA LEVEL								
		5% AEP		2% AEP		1% AEP		0.2% AEP	
Environmental Asset	Ecosystem Recovery Rating	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE
Estuary	2	1	2	1	2	2	4	3	6
Small Inlet	2	1	2	1	2	2	4	3	6
Beach	1	2	2	3	3	4	4	5	5
Rocky and Coral Reefs	1	1	1	1	1	2	2	3	3
Seagrass	1	1	1	2	2	3	3	4	4
Soft Bottom Habitat	1	1	1	2	2	3	3	4	4
12.1.1 Tidal flats and beaches Casuarina glauca	1	2	2	3	3	4	4	5	5
12.3.3 Alluvial river and creek flats Eucalyptus tereticornis woodland	1	3	3	4	4	5	5	5	5
12.3.7 Alluvial river and creek flats Eucalyptus tereticornis	1	3	3	4	4	5	5	5	5
12.3.11 Alluvial river and creek flats Eucalyptus tereticornis	1	3	3	4	4	5	5	5	5
12.8.16 Basalt plains and hills Eucalyptus crebra	1	3	3	4	4	5	5	5	5
	TOTAL		23		31		44		53
	CONSEQUENCE		Insignificant		Insignificant		Minor		Minor

	0.2M SEA LEVEL RISE								
		5% AEP		2% AEP		1% AEP		0.2% AEP	
Environmental Asset	Ecosystem Recovery Rating	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE
Estuary	3	1	3	1	3	2	6	3	9
Small Inlet	3	1	3	1	3	2	6	3	9
Beach	2	2	4	3	6	4	8	5	10
Rocky and Coral Reefs	1	1	1	1	1	2	2	3	3
Seagrass	1	1	1	2	2	3	3	4	4
Soft Bottom Habitat	2	1	2	2	4	3	6	4	8
12.1.1 Tidal flats and beaches Casuarina glauca	1	2	2	3	3	4	4	5	5
12.3.3 Alluvial river and creek flats Eucalyptus tereticornis woodland	1	3	3	4	4	5	5	5	5
12.3.7 Alluvial river and creek flats Eucalyptus tereticornis	1	3	3	4	4	5	5	5	5
12.3.11 Alluvial river and creek flats Eucalyptus tereticornis	1	3	3	4	4	5	5	5	5
12.8.16 Basalt plains and hills Eucalyptus crebra	1	3	3	4	4	5	5	5	5
	TOTAL		28		38		55		68
	CONSEQUENCE		Insignificant		Insignificant		Minor		Minor

	0.4M SEA LEVEL RISE								
		5% AEP		2% AEP		1% AEP		0.2% AEP	
Environmental Asset	Ecosystem Recovery Rating	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE
Estuary	4	1	4	1	4	2	8	3	12
Small Inlet	4	1	4	1	4	2	8	3	12
Beach	3	2	6	3	9	4	12	5	15
Rocky and Coral Reefs	1	1	1	1	1	2	2	3	3
Seagrass	2	1	2	2	4	3	6	4	8
Soft Bottom Habitat	3	1	3	2	6	3	9	4	12
12.1.1 Tidal flats and beaches Casuarina glauca	2	2	4	3	6	4	8	5	10
12.3.3 Alluvial river and creek flats Eucalyptus tereticornis woodland	2	3	6	4	8	5	10	5	10
12.3.7 Alluvial river and creek flats Eucalyptus tereticornis	2	3	6	4	8	5	10	5	10
12.3.11 Alluvial river and creek flats Eucalyptus tereticornis	2	3	6	4	8	5	10	5	10
12.8.16 Basalt plains and hills Eucalyptus crebra	1	3	3	4	4	5	5	5	5
	TOTAL		45		62		88		107
	CONSEQUENCE		Minor		Minor		Moderate		Moderate

	0.8M SEA LEVEL RISE								
		5% AEP		2% AEP		1% AEP		0.2% AEP	
Environmental Asset	Ecosystem Recovery Rating	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE
Estuary	5	1	5	1	5	2	10	3	15
Small Inlet	5	1	5	1	5	2	10	3	15
Beach	4	2	8	3	12	4	16	5	20
Rocky and Coral Reefs	1	1	1	1	1	2	2	3	3
Seagrass	3	1	3	2	6	3	9	4	12
Soft Bottom Habitat	4	1	4	2	8	3	12	4	16
12.1.1 Tidal flats and beaches Casuarina glauca	3	2	6	3	9	4	12	5	15
12.3.3 Alluvial river and creek flats Eucalyptus tereticornis woodland	3	3	9	4	12	5	15	5	15
12.3.7 Alluvial river and creek flats Eucalyptus tereticornis	3	3	9	4	12	5	15	5	15
12.3.11 Alluvial river and creek flats Eucalyptus tereticornis	3	3	9	4	12	5	15	5	15
12.8.16 Basalt plains and hills Eucalyptus crebra	2	3	5	4	8	5	10	6	12
	TOTAL		64		90		126		153
	CONSEQUENCE		Minor		Moderate		Major		Major

COONARR

	CURRENT SEA LEVEL								
		5% AEP		2% AEP		1% AEP		0.2% AEP	
Environmental Asset	Ecosystem Recovery Rating	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE
Estuary	2	1	2	1	2	2	4	3	6
Small Inlet	2	1	2	1	2	2	4	3	6
Beach	1	2	2	3	3	4	4	5	5
Rocky and Coral Reefs	1	1	1	1	1	2	2	3	3
Soft Bottom Habitat	1	1	1	2	2	3	3	4	4
12.1.1 Tidal flats and beaches Casuarina glauca	1	2	2	3	3	4	4	5	5
12.2.2 Coastal dunes Microphyll/notophyll vine forest	1	3	3	4	4	5	5	5	5
12.2.12 Coastal dunes Closed heath	1	3	3	4	4	5	5	5	5
12.3.11 Alluvial river and creek flats Eucalyptus tereticornis	1	3	3	4	4	5	5	5	5
12.5.2a Old loamy and sandy plains Corymbia intermediate	1	3	3	4	4	5	5	5	5
	TOTAL		22		29		41		49
	CONSEQUENCE		Insignificant		Insignificant		Insignificant		Minor

	0.2M SEA LEVEL RISE								
		5% AEP		2% AEP		1% AEP		0.2% AEP	
Environmental Asset	Ecosystem Recovery Rating	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE
Estuary	3	1	3	1	3	2	6	3	9
Small Inlet	3	1	3	1	3	2	6	3	9
Beach	2	2	4	3	6	4	8	5	10
Rocky and Coral Reefs	1	1	1	1	1	2	2	3	3
Soft Bottom Habitat	2	1	2	2	4	3	6	4	8
12.1.1 Tidal flats and beaches Casuarina glauca	1	2	2	3	3	4	4	5	5
12.2.2 Coastal dunes Microphyll/notophyll vine forest	1	3	3	4	4	5	5	5	5
12.2.12 Coastal dunes Closed heath	1	3	3	4	4	5	5	5	5
12.3.11 Alluvial river and creek flats Eucalyptus tereticornis	1	3	3	4	4	5	5	5	5
12.5.2a Old loamy and sandy plains Corymbia intermediate	1	3	3	4	4	5	5	5	5
	TOTAL		27		36		52		64
	CONSEQUENCE		Insignificant		Insignificant		Minor		Minor

	0.4M SEA LEVEL RISE								
		5% AEP		2% AEP		1% AEP		0.2% AEP	
Environmental Asset	Ecosystem Recovery Rating	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE
Estuary	4	1	4	1	4	2	8	3	12
Small Inlet	4	1	4	1	4	2	8	3	12
Beach	3	2	6	3	9	4	12	5	15
Rocky and Coral Reefs	0	1	0	1	0	2	0	3	0
Soft Bottom Habitat	3	1	3	2	6	3	9	4	12
12.1.1 Tidal flats and beaches Casuarina glauca	2	2	4	3	6	4	8	5	10
12.2.2 Coastal dunes Microphyll/notophyll vine forest	1	3	3	4	4	5	5	5	5
12.2.12 Coastal dunes Closed heath	1	3	3	4	4	5	5	5	5
12.3.11 Alluvial river and creek flats Eucalyptus tereticornis	2	3	6	4	8	5	10	5	10
12.5.2a Old loamy and sandy plains Corymbia intermediate	1	3	3	4	4	5	5	5	5
	TOTAL		36		49		70		86
	CONSEQUENCE		Insignificant		Minor		Minor		Moderate

		0.8M SEA LEVEL RISE							
		5% AEP		2% AEP		1% AEP		0.2% AEP	
Environmental Asset	Ecosystem Recovery Rating	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE
Estuary	5	1	5	1	5	2	10	3	15
Small Inlet	5	1	5	1	5	2	10	3	15
Beach	4	2	8	3	12	4	16	5	20
Rocky and Coral Reefs	1	1	1	1	1	2	2	3	3
Soft Bottom Habitat	4	1	4	2	8	3	12	4	16
12.1.1 Tidal flats and beaches Casuarina glauca	3	2	6	3	9	4	12	5	15
12.2.2 Coastal dunes Microphyll/notophyll vine forest	2	3	6	4	8	5	10	5	10
12.2.12 Coastal dunes Closed heath	2	3	6	4	8	5	10	5	10
12.3.11 Alluvial river and creek flats Eucalyptus tereticornis	3	3	9	4	12	5	15	5	15
12.5.2a Old loamy and sandy plains Corymbia intermediate	2	3	6	4	8	5	10	5	10
	TOTAL		56		76		107		129
	CONSEQUENCE		Minor		Minor		Moderate		Major

WOODGATE BEACH & WALKERS POINT

	CURRENT SEA LEVEL								
		5% AEP		2% AEP		1% AEP		0.2% AEP	
Environmental Asset	**Ecosystem Recovery Rating**	**Ecosystem Sensitivity Score**	**TOTAL SCORE**	**Ecosystem Sensitivity Score**	**TOTAL SCORE**	**Ecosystem Sensitivity Score**	**TOTAL SCORE**	**Ecosystem Sensitivity Score**	**TOTAL SCORE**
Estuary	2	1	2	1	2	2	4	3	6
Beach	1	2	2	3	3	4	4	5	5
Rocky and Coral Reefs	1	1	1	1	1	2	2	3	3
Seagrass	1	1	1	2	2	3	3	4	4
Soft Bottom Habitat	1	1	1	2	2	3	3	4	4
12.1.1 Tidal flats and beaches Casuarina glauca	1	2	2	3	3	4	4	5	5
12.2.12 Coastal dunes Closed heath	1	3	3	4	4	5	5	5	5
12.3.7 Alluvial river and creek flats Eucalyptus tereticornis	1	3	3	4	4	5	5	5	5
12.3.7b Alluvial river and creek flats Naturally occurring instream waterholes and lagoons	1	3	3	4	4	5	5	5	5
12.3.11 Alluvial river and creek flats Eucalyptus tereticornis	1	3	3	4	4	5	5	5	5
12.3.14 Alluvial river and creek flats Banksia aemula	1	3	3	4	4	5	5	5	5
	TOTAL		**24**		**33**		**45**		**52**
	CONSEQUENCE		**Insignificant**		**Minor**		**Minor**		**Minor**

	0.2M SEA LEVEL RISE								
		5% AEP		2% AEP		1% AEP		0.2% AEP	
Environmental Asset	**Ecosystem Recovery Rating**	**Ecosystem Sensitivity Score**	**TOTAL SCORE**	**Ecosystem Sensitivity Score**	**TOTAL SCORE**	**Ecosystem Sensitivity Score**	**TOTAL SCORE**	**Ecosystem Sensitivity Score**	**TOTAL SCORE**
Estuary	3	1	3	1	3	2	6	3	9
Beach	2	2	4	3	6	4	8	5	10
Rocky and Coral Reefs	1	1	1	1	1	2	2	3	3
Seagrass	1	1	1	2	2	3	3	4	4
Soft Bottom Habitat	2	1	2	2	4	3	6	4	8
12.1.1 Tidal flats and beaches Casuarina glauca	1	2	2	3	3	4	4	5	5
12.2.12 Coastal dunes Closed heath	1	3	3	4	4	5	5	5	5
12.3.7 Alluvial river and creek flats Eucalyptus tereticornis	1	3	3	4	4	5	5	5	5
12.3.7b Alluvial river and creek flats Naturally occurring instream waterholes and lagoons	1	3	3	4	4	5	5	5	5
12.3.11 Alluvial river and creek flats Eucalyptus tereticornis	1	3	3	4	4	5	5	5	5
12.3.14 Alluvial river and creek flats Banksia aemula	1	3	3	4	4	5	5	5	5
	TOTAL		**28**		**39**		**54**		**64**
	CONSEQUENCE		**Insignificant**		**Minor**		**Minor**		**Moderate**

	0.4M SEA LEVEL RISE								
		5% AEP		2% AEP		1% AEP		0.2% AEP	
Environmental Asset	**Ecosystem Recovery Rating**	**Ecosystem Sensitivity Score**	**TOTAL SCORE**	**Ecosystem Sensitivity Score**	**TOTAL SCORE**	**Ecosystem Sensitivity Score**	**TOTAL SCORE**	**Ecosystem Sensitivity Score**	**TOTAL SCORE**
Estuary	4	1	4	1	4	2	8	3	12
Beach	3	2	6	3	9	4	12	5	15
Rocky and Coral Reefs	1	1	1	1	1	2	2	3	3
Seagrass	2	1	2	2	4	3	6	4	8
Soft Bottom Habitat	3	1	3	2	6	3	9	4	12
12.1.1 Tidal flats and beaches Casuarina glauca	2	2	4	3	6	4	8	5	10
12.2.12 Coastal dunes Closed heath	1	3	3	4	4	5	5	5	5
12.3.7 Alluvial river and creek flats Eucalyptus tereticornis	2	3	6	4	8	5	10	5	10
12.3.7b Alluvial river and creek flats Naturally occurring instream waterholes and lagoons	2	3	6	4	8	5	10	5	10
12.3.11 Alluvial river and creek flats Eucalyptus tereticornis	2	3	6	4	8	5	10	5	10
12.3.14 Alluvial river and creek flats Banksia aemula	2	3	6	4	8	5	10	5	10
	TOTAL		**47**		**66**		**90**		**105**
	CONSEQUENCE		**Minor**		**Moderate**		**Moderate**		**Major**

	0.8M SEA LEVEL RISE								
		5% AEP		2% AEP		1% AEP		0.2% AEP	
Environmental Asset	Ecosystem Recovery Rating	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE
Estuary	5	1	5	1	5	2	10	3	15
Beach	4	2	8	3	12	4	16	5	20
Rocky and Coral Reefs	1	1	1	1	1	2	2	3	3
Seagrass	3	1	3	2	6	3	9	4	12
Soft Bottom Habitat	4	1	4	2	8	3	12	4	16
12.1.1 Tidal flats and beaches Casuarina glauca	3	2	6	3	9	4	12	5	15
12.2.12 Coastal dunes Closed heath	2	3	6	4	8	5	10	5	10
12.3.7 Alluvial river and creek flats Eucalyptus tereticornis	3	3	9	4	12	5	15	5	15
12.3.7b Alluvial river and creek flats Naturally occurring instream waterholes and lagoons	3	3	9	4	12	5	15	5	15
12.3.11 Alluvial river and creek flats Eucalyptus tereticornis	3	3	9	4	12	5	15	5	15
12.3.14 Alluvial river and creek flats Banksia aemula	3	3	9	4	12	5	15	5	15
	TOTAL		69		97		131		151
	CONSEQUENCE		Moderate		Major		Catastrophic		Catastrophic

BUXTON

		CURRENT SEA LEVEL							
		5% AEP		2% AEP		1% AEP		0.2% AEP	
Environmental Asset	Ecosystem Recovery Rating	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE
Estuary	2	1	2	1	2	2	4	3	6
Small Inlet	2	1	2	1	2	2	4	3	6
Seagrass	1	1	1	2	2	3	3	4	4
Soft Bottom Habitat	1	1	1	2	2	3	3	4	4
12.3.7 Alluvial river and creek flats Eucalyptus tereticornis	1	3	3	4	4	5	5	5	5
12.3.7b Alluvial river and creek flats Naturally occurring instream waterholes and lagoons	1	3	3	4	4	5	5	5	5
12.3.11 Alluvial river and creek flats Eucalyptus tereticornis	1	3	3	4	4	5	5	5	5
12.5.8 Old loamy and sandy plains Eucalyptus hallii open woodland	1	3		4		5	5	5	
	TOTAL		15		20		34		35
	CONSEQUENCE		Insignificant		Insignificant		Insignificant		Insignificant

		0.2M SEA LEVEL RISE							
		5% AEP		2% AEP		1% AEP		0.2% AEP	
Environmental Asset	Ecosystem Recovery Rating	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE
Estuary	3	1	3	1	3	2	6	3	9
Small Inlet	3	1	3	1	3	2	6	3	9
Seagrass	1	1	1	2	2	3	3	4	4
Soft Bottom Habitat	2	1	2	2	4	3	6	4	8
12.3.7 Alluvial river and creek flats Eucalyptus tereticornis	1	3	3	4	4	5	5	5	5
12.3.7b Alluvial river and creek flats Naturally occurring instream waterholes and lagoons	1	3	3	4	4	5	5	5	5
12.3.11 Alluvial river and creek flats Eucalyptus tereticornis	1	3	3	4	4	5	5	5	5
12.5.8 Old loamy and sandy plains Eucalyptus hallii open woodland	1	3		4		5	5	5	
	TOTAL		18		24		41		45
	CONSEQUENCE		Insignificant		Insignificant		Minor		Minor

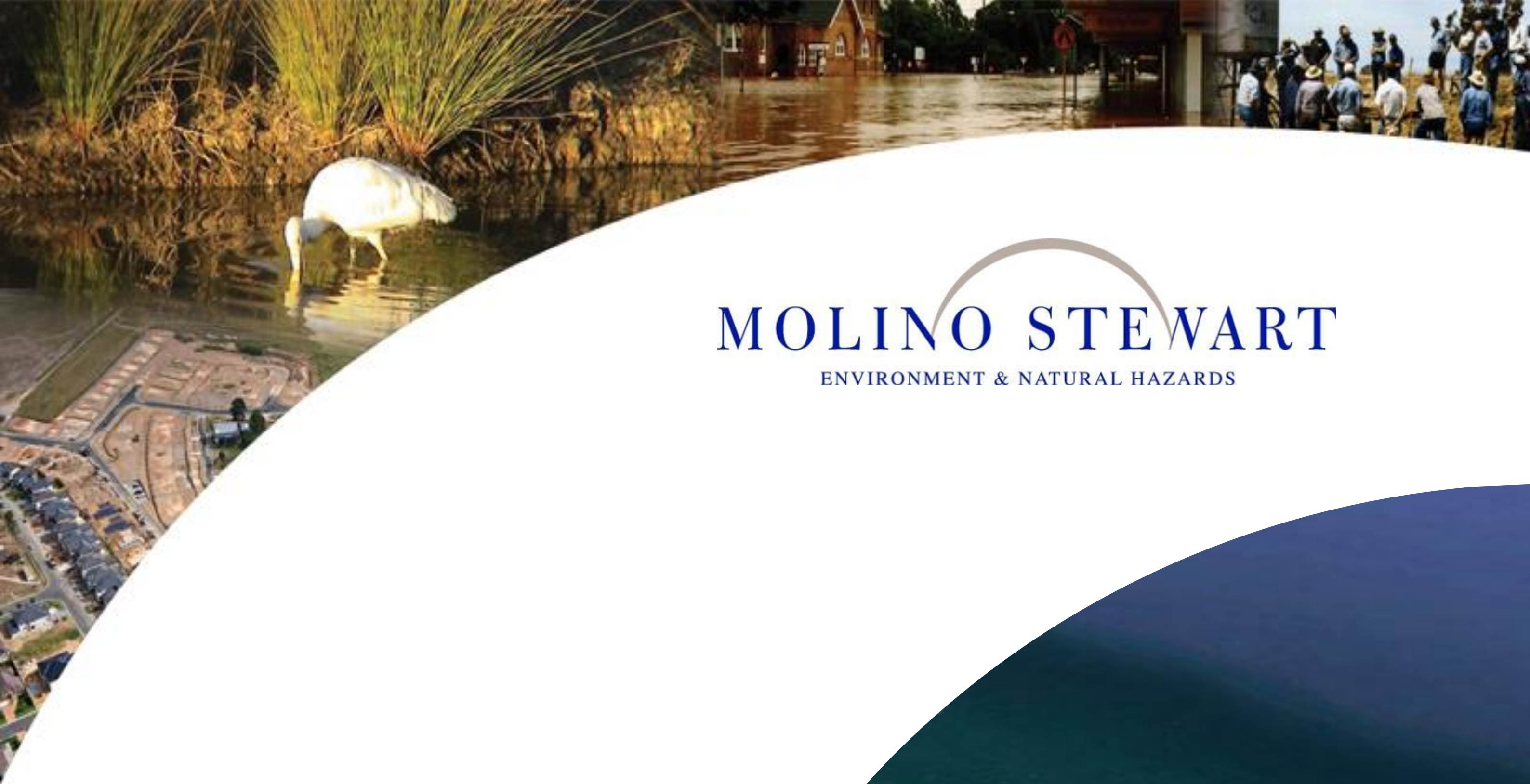
		0.4M SEA LEVEL RISE							
		5% AEP		2% AEP		1% AEP		0.2% AEP	
Environmental Asset	Ecosystem Recovery Rating	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE
Estuary	4	1	4	1	4	2	8	3	12
Small Inlet	4	1	4	1	4	2	8	3	12
Seagrass	2	1	2	2	4	3	6	4	8
Soft Bottom Habitat	3	1	3	2	6	3	9	4	12
12.3.7 Alluvial river and creek flats Eucalyptus tereticornis	2	3	6	4	8	5	10	5	10
12.3.7b Alluvial river and creek flats Naturally occurring instream waterholes and lagoons	2	3	6	4	8	5	10	5	10
12.3.11 Alluvial river and creek flats Eucalyptus tereticornis	2	3	6	4	8	5	10	5	10
12.5.8 Old loamy and sandy plains Eucalyptus hallii open woodland	1	3	3	4	4	5	5	5	5
	TOTAL		34		46		66		79
	CONSEQUENCE		Insignificant		Minor		Minor		Minor

		0.8M SEA LEVEL RISE							
		5% AEP		2% AEP		1% AEP		0.2% AEP	
Environmental Asset	Ecosystem Recovery Rating	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE	Ecosystem Sensitivity Score	TOTAL SCORE
Estuary	5	1	5	1	5	2	10	3	15
Small Inlet	5	1	5	1	5	2	10	3	15
Seagrass	3	1	3	2	6	3	9	4	12
Soft Bottom Habitat	4	1	4	2	8	3	12	4	16
12.3.7 Alluvial river and creek flats Eucalyptus tereticornis	3	3	9	4	12	5	15	5	15
12.3.7b Alluvial river and creek flats Naturally occurring instream waterholes and lagoons	3	3	9	4	12	5	15	5	15
12.3.11 Alluvial river and creek flats Eucalyptus tereticornis	3	3	9	4	12	5	15	5	15
12.5.8 Old loamy and sandy plains Eucalyptus hallii open woodland	2	3	6	4	8	5	10	5	10
	TOTAL		50		68		96		113
	CONSEQUENCE		Minor		Minor		Moderate		Moderate

Coastal Settlement	Habitat Type Risk Score															
	Current SLR				0.2m SLR				0.4m SLR				0.8m SLR			
	5%	2%	1%	0.2%	5%	2%	1%	0.2%	5%	2%	1%	0.2%	5%	2%	1%	0.2%
Miara and Norval Park	35	47	64	73	40	54	75	88	63	86	118	137	95	130	176	201
Moore Park Beach	18	24	34	41	23	31	45	56	36	49	70	86	52	71	100	121
Burnett Heads	24	33	45	52	28	39	54	64	47	66	90	105	69	97	131	151
Bargara	9	12	20	28	14	19	31	43	20	28	45	62	21	37	59	81
Innes Park and Coral Cove	10	14	21	27	14	20	30	39	19	28	42	55	27	40	59	76
Elliott Heads	23	31	44	53	28	38	55	68	45	62	88	107	64	90	126	153
Coonarr	22	29	41	49	27	36	52	64	36	49	70	86	56	76	107	129
Woodgate Beach	24	33	45	52	28	39	54	64	47	66	90	105	69	97	131	151
Buxton	15	20	34	35	18	24	41	45	34	46	66	79	50	68	96	113

Coastal Settlement	Habitat Type Associated Consequence															
	Current SLR				0.2m SLR				0.4m SLR				0.8m SLR			
	5%	2%	1%	0.2%	5%	2%	1%	0.2%	5%	2%	1%	0.2%	5%	2%	1%	0.2%
Miara and Norval Park	Insignificant	Insignificant	Minor	Minor	Insignificant	Insignificant	Minor	Minor	Minor	Minor	Moderate	Moderate	Minor	Moderate	Major	Major
Moore Park Beach	Insignificant	Insignificant	Minor	Minor	Insignificant	Insignificant	Minor	Minor	Minor	Minor	Moderate	Moderate	Minor	Moderate	Major	Major
Burnett Heads	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant	Minor	Minor	Insignificant	Insignificant	Minor	Minor
Bargara	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant	Minor	Insignificant	Insignificant	Minor	Minor	Insignificant	Insignificant	Minor	Moderate
Innes Park and Coral Cove	Insignificant	Insignificant	Minor	Minor	Insignificant	Insignificant	Minor	Minor	Insignificant	Minor	Minor	Moderate	Minor	Minor	Moderate	Major
Elliott Heads	Insignificant	Insignificant	Minor	Minor	Insignificant	Insignificant	Minor	Minor	Minor	Minor	Moderate	Moderate	Minor	Moderate	Major	Major
Coonarr	Insignificant	Insignificant	Insignificant	Minor	Insignificant	Insignificant	Minor	Minor	Insignificant	Minor	Minor	Moderate	Minor	Minor	Moderate	Major
Woodgate Beach	Insignificant	Minor	Minor	Minor	Insignificant	Minor	Minor	Moderate	Minor	Moderate	Moderate	Major	Moderate	Major	Catastrophic	Catastrophic
Buxton	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant	Minor	Minor	Insignificant	Minor	Minor	Minor	Minor	Minor	Moderate	Moderate

APPENDIX E - ECONOMIC AND SOCIAL ANALYSIS TECHNICAL REPORT AND CONSEQUENCE RESULTS



MOLINO STEWART
ENVIRONMENT & NATURAL HAZARDS

Bundaberg Regional Council

Bundaberg Coastal Hazard Assessment Strategy - Risk Assessment

Final Report

Bundaberg Coastal Hazard Assessment Strategy - Risk Assessment

FINAL REPORT

for

Bundaberg Regional Council

by

Molino Stewart Pty Ltd
ACN 067 774 332

OCTOBER 2019

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ENVIRONMENT & NATURAL HAZARDS

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1 INTRODUCTION

This phase of the CHAS assessed and mapped risk posed to the study area by the coastal hazards identified as part of Phase 3.

Risk is defined as the combination of the probability of an event (i.e. the "hazard") and its negative consequences (UNISDR, 2009). A natural hazard is defined as a natural process, or phenomenon that may cause loss of life, injury or other health impacts, property damage, social and economic disruption or environmental degradation (UNISDR, 2009).

When looked at through the lens of climate change, the timescale of natural hazards expands from hours or days (e.g. storm surges, short term coastal erosion, or "storm bite"), to decades or centuries (e.g. sea level rise). As such, the risk of impacts from these events needs to be assessed on multiple time-scales.

Because storm surges and erosion are short term hazards, while sea level rise is a longer term process, a scenario-based approach was used in which storm surges and erosion of various intensities (and different probability of occurrence) were assumed to occur under a range of different initial sea level conditions, namely:

- Current conditions;
- 0.2m of sea level rise;
- 0.4m of sea level rise;
- 0.8m of sea level rise.

Natural hazards are generally assessed based on three attributes:

- Probability of occurrence. This was expressed as the hazard's Annual Exceedance Probability (AEP), representing the probability that a hazard of a given intensity has to be reached or exceeded every year. The following AEP events were considered when assessing risk: 5% AEP, 2% AEP, 1% AEP, 0.2% AEP, with the latter having data only for storm surges. These approximately correspond to the 20, 50, 100 and 500 year ARI (Average Recurrence Interval) events respectively.

  Consistent with the CHAS Minimum Standards and Guidelines (State of Queensland, 2016), the probability of occurrence of erosion and storm surges were assumed to be independent, meaning that a given AEP erosion event will not necessarily be triggered by the corresponding AEP storm surge event.

  With regard to sea level rise, it was assumed that the forecasted increases of 0.2m, 0.4m and 0.8m will occur in 20, 40 and 80 years from today, respectively. This corresponds to an average sea level increase of 1cm per year, and a total increase of 80cm by year 2100, which is the Queensland Government's adopted sea level rise benchmark.

- Intensity. For storm surges, the peak inundation depth reached by each AEP event was used as hazard intensity indicator, or hazard "demand" parameter. For erosion and sea level rise, a yes/no approach was adopted to identify areas and assets assumed to be affected (or not affected) by these hazards.;
- Spatial distribution. This was obtained by mapping erosion prone areas and the storm peak inundation depth for each AEP event and under each initial sea level condition.

Hazard probability, intensity and spatial distribution were obtained in Phase 3 of the CHAS and presented in the form of GIS thematic layers to be used as inputs for the risk assessment exercise.

2 METHODS

This phase of the CHAS assessed risk in terms of the consequences (i.e. the damages) that the study area would incur under each hazard scenario. Where possible, damages were quantified in monetary terms and converted to Net Present Value (NPV) to discount future costs to present day values to account for the time value of money.

The following risks were assessed:

- **Economic Risk**, including tangible damages estimates to infrastructure, residential and non residential buildings. Tangible damages include direct and indirect damages. These were estimated as absolute figures (i.e. damages in dollars) and in relative terms (i.e. proportion of damages incurred in each scenario calculated with respect to the total value of infrastructure, residential and non residential buildings at risk in the worst case scenario);

- **Social Risk**, including intangible damages and risk to life. Similarly to Economic Risk, Social Risk was assessed with absolute figures (i.e. damages in dollars, and number of people at risk), and relative terms (i.e. proportion of intangible damages incurred in each scenario calculated with respect to the total intangible value at risk in the worst case scenario, and proportion of people at risk in each scenario with respect to the total number of people at risk in the worst case scenario);
- **Environmental Risk**, impacts to coastal ecosystems of significant ecological, conservational or biodiversity value were assessed by proportioning the range and scale of the ecosystem types impacted combined with the ability of ecosystem to recover from coastal hazard events and the sensitivity of the ecosystem assigned within the Vulnerability Assessment.

2.1 RISK TO THE BUILT ENVIRONMENT

Figure 1 summarises the possible types of damages to the built environment from natural hazards (DIPNR, 2015, modified). The two main categories are tangible and intangible damages. Tangible damages are those that can be more readily evaluated in monetary terms. Intangible damages relate to the social cost of natural hazards and are more difficult to quantify in monetary terms and often difficult to quantify using other metrics.

Tangible and intangible damages are further divided into direct and indirect damages. Direct damages relate to the loss (or loss in value) of an object or a piece of property caused by direct contact with the hazard (e.g. with floodwaters). Indirect damages relate to loss in production or revenue, loss of wages, additional accommodation costs and living expenses, and any extra outlays that occur because of the hazard. The following subsections explain how each damage type was assessed for buildings (residential and non-residential) and infrastructure.

The analysis was undertaken using a dataset in GIS format provided by Council and containing building footprints and critical infrastructure across the study area. The dataset did not contain information on the floor level for about 75% of residential buildings. These were assumed to have the same design as the most common residential building types in the study area, i.e. single storey houses with a floor height of 0.3m above ground.

In addition to this, all buildings labelled as non-habitable or having an area smaller than 30 m^2 were assumed to be sheds and were deleted from the dataset.

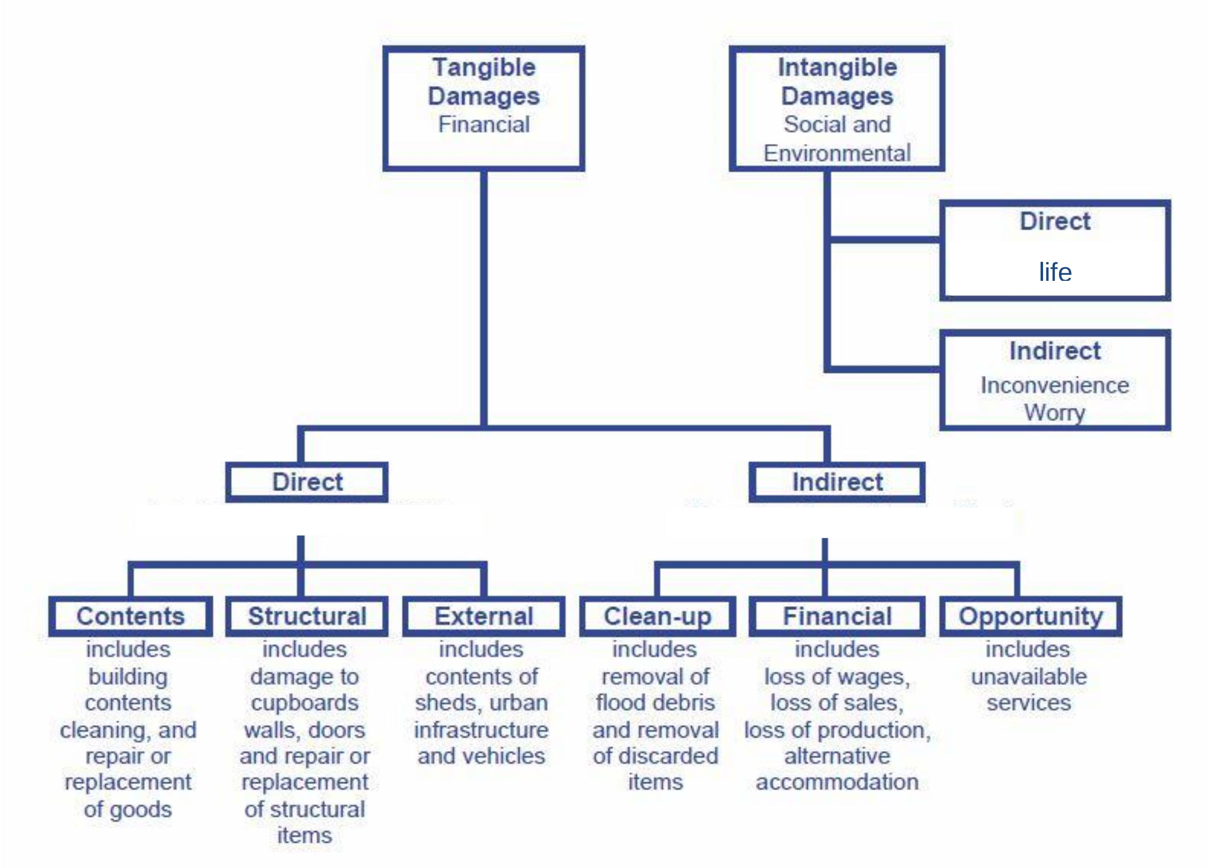

Figure 1. Types of damages to the built environment (DIPNR, 2005, modif.)

2.1.1 Residential Buildings

Damages to residential buildings were assessed using a damage model appropriate for the hazard considered. For instance, damage from inundation is proportional to the inundation depth and may require only minor repairs and clean up before the building can be used again. On the other hand, damage from erosion or sea level rise is likely to result in the building being permanently lost, either because its foundations are undermined or because the building becomes regularly inundated.

a) Direct Damages

i) Estimating the Exposed Value

Depending on the model used, direct damages were assessed based on the expected loss of value of the building structure, the building contents and the land. Council's building dataset allowed differentiation between the following three residential building types:

- Single storey houses;
- Double storey houses;
- Units.

The value of the building structure for each of the above mentioned building types was obtained from average 2018 construction costs per square metre for Australian buildings estimated for tax depreciation purposes (https://www.bmtqs.com.au/construction-cost-table). The average area of each building type was obtained from Council's building dataset. Finally, the overall building replacement costs were obtained by augmenting construction costs by a factor of 1.2, to account for demolition and clean up (Geoscience Australia, 2012)(Table 1).

Table 1. Replacement costs for residential buildings in the study area

Dwelling type	**Construction cost (per m^2)**	**Average Area (m^2)**	**Total Construction Cost**	**Total Replacement cost (incl. demolition)**
Single Storey	$1,849	207	$382,778	$459,333
Double Storey	$2,049	427	$875,137	$1,050,164
Unit	$2,277	80	$182,200	$218,640

Contents value for each building type was obtained from a dataset developed by Geoscience Australia after the 2011 Brisbane floods (Geoscience Australia, 2012b). Geoscience Australia listed all the items that are likely to be found in Australian residential homes of different types and size. These were averaged to match the three building types available in Council's building dataset. Finally, the overall content values were inflated to present day using a rate based on the ratio between the Average Weekly Earnings in 2018 and in 2012 (http://www.qgso.qld.gov.au/products/tables/average-weekly-earnings-qld-aus/index.php). The resulting total contents replacement costs were:

- Single storey houses: $89,618;
- Double storey houses: $1,050,164;
- Units: $218,640.

Finally, the value of land was required to assess permanent losses of the lot resulting from erosion or sea level rise. These were obtained from average current residential land selling price per square meter used in real estate for beach-front lots (or lots close to the beach) within the study area, and were:

- Burnett Heads: $150
- Moore Park Beach: $100
- Woodgate Beach: $350
- Miara and Norval Park: $100
- Bargara: $400
- Buxton: $100
- Coonarr: $50;
- Elliott Heads: $250
- Innes Park and Coral Cove: $250
- Remainder of Bundaberg LGA: $100.

It was then assumed an average lot area of 1,000 m^2.

ii) Damage Models

A different damage model, or a set of damage assumptions, were used depending on the hazard type.

Sea Level Rise

Sea level rise is a slow onset, permanent hazard in nature, and as such it was assumed to cause a complete loss of the building and land value. The value of building contents was excluded because there would be sufficient time to move these elsewhere before the building is lost. Finally, it was assumed that if a building were affected by sea level rise, no further damage from erosion or storm surge would be possible.

Erosion

With regard to erosion, it was assumed that buildings within the erosion-prone areas would have their foundations undermined. As such, direct damages to these buildings were assumed to be equal to the total building and contents replacement value. It was also assumed that the damage from erosion would be permanent and that in most instances this would result in the building owner not being able or willing to rebuild at the same location, although it is noted that in a small number of cases (e.g. areas exposed to temporary erosion, or “storm bite”) this may be possible. However the geomorphological features of the Bundaberg coastal zone are such that areas exposed to short term erosion (or “storm bite”) occupy a relatively small proportion of the overall areas exposed to all types of erosion. For this reason this assumption was deemed compatible with the scope of this CHAS. As previously mentioned, no further erosion damage would be possible for any buildings affected by sea level rise, and as such these buildings were discounted from the erosion damages assessment.

Storm Surge

For tangible direct damage from storm surge inundation, a literature review was undertaken to identify the most suitable damage model for residential and non-residential buildings.

Damages from flooding or inundation to buildings are typically predicted using “building fragility curves”. These are curves associating the intensity of the flood hazard to the damage level that this is expected to cause. The most commonly used quantitative model for building damage from inundation and flooding are referred to as “stage-damage” curves. These define a relationship between peak water depth impacting the building and the resulting level of damage. While the damage to any structure depends both on water depth and flow velocity, in most instances peak depth and velocity are highly correlated. As such, for simplicity most building fragility models utilise peak depth (i.e. the water “stage”) as the only hazard “demand” parameter, and are therefore referred to as “stage-damage” curves.

The former NSW Department of Environment and Climate Change, now Office of Environment, and Heritage created a set of stage-damage curves for typical NSW residential dwellings, and produced an Excel calculation spreadsheet to automatically obtain damage estimates on a building by building basis. While the calculation spreadsheet offers several practical advantages, these curves were deemed inappropriate for this CHAS because they were based on damage from riverine flooding rather than storm surge, were developed for building types different from those observed in the study area and were based on data which is now more than 20 years old.

Stage damage curves specifically developed for storm surge impact on typical Queensland residential buildings were provided by Geoscience Australia (2012). These curves were developed based on actual damage observations and insurance claims after cyclone Yasi and provided an estimate of structural damage only (building contents was not included).

Contents damage was calculated using a different set of curves, developed by Geoscience Australia after the 2011 Brisbane floods (Geoscience Australia, 2012b). Although these were obtained by observing damages after a riverine flood, it was deemed reasonable to assume that the damage to the building contents would have been the same as if it had been caused by a storm surge of equal depth.

It is important to emphasize that, being based on actual costs, these damage models already accounted for post disaster reconstruction inflation factors.

Geoscience Australia stage-damage curves were then organised in Excel calculation spreadsheets, using the same format used by the NSW Department of Climate Change.

Geoscience Australia's stage-damage curves were provided for a number of building types greater than what the available Council's building dataset allowed to identify in the study area. As such, Geoscience Australia's curves were aggregated as shown in Table 2.

Table 2. Summary of damage curves from Geoscience Australia (2012a, 2012b) aggregated to obtain curves suitable for the study area

	Aggregated structural damage curves (GA, 2012a)	Aggregated contents damage curves (GA,2012b)
Single Storey Houses	SSCM1, SSCM2, SSCM3	FCM8
Double Storey Houses	SSCM6, SSCM7	FCM3, FCM4, FCM5, FCM6
Units	SSCM4	FCM8

In generating stage damage curves suitable for the study area, the following assumptions were made:

- Geoscience Australia's contents damage model included curves for households with and without content insurance and accounting for three possible behaviours of the building occupants before the storm: protect content by moving it at a higher level, exposing content by moving it to lower level (to claim a greater insurance compensation), or do nothing. These were aggregated in a single curve per each building type using a weighted average based on the proportion of Australian households with and without contents insurance (i.e. 71% and 29% respectively) (Tooth, 2015). The damage figures corresponding to the three different occupant behaviours were averaged excluding the option of exposing contents because it was deemed relatively unlikely to happen;
- Rather than providing the actual damage expressed in dollars, Geoscience Australia's structural damage curves outputted a Damage Index for each inundation depth, raging from zero to 1. The Damage Index represented the ratio between the cost to repair a given damage and the cost to replace the whole building (or the content). This included an allowance of +30% for structural repair costs to cover items such as the removal of the damaged parts, or the cost of matching the existing building style, and +20% for building replacement costs (to cover demolition). The Damage Index was applied to the total building structural and content replacement value to obtain the cost to repair the building structure or to replace the contents. Buildings were assumed to need full replacement when repair was uneconomical.
- Geoscience Australia's content damage curves came with a spreadsheet providing the cost to replace and repair (if repairable) of all the most common items found in Australian homes. Because these costs were published in 2012, they were then inflated to year 2018 using an inflation rate based on the ratio between the relevant Average Weekly Earnings (AWE).

The resulting storm stage-damage curves for residential buildings, inclusive of damage to contents, are shown in Figure 3.

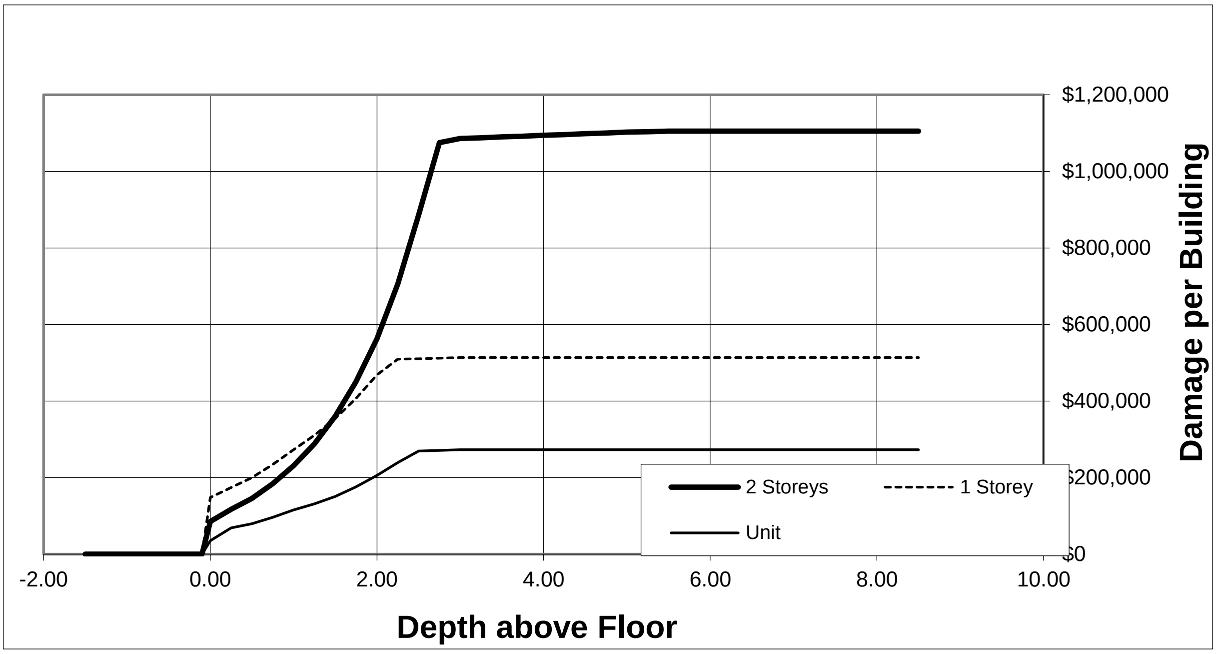

Figure 2. Residential stage-damage curves for storm surge

b) Indirect Damages

For the residential sector, indirect damages caused by storm surge inundation include clean-up costs and the costs of alternative accommodation while the house is being repaired and cleaned up. A number of methods have been put forward for estimating these costs either individually or in aggregate.

The simplest method used has estimated indirect damages as a percentage of direct damages. Past research into the percentages assumed has indicated ranges of between 5% and 40% depending on what was included in the damage estimates (for example, the lower end of the range excluded clean-up costs) and the scale of the impacts.

The NSW OEH recommends a clean-up cost of $4,000 (2001 dollars) per building following a flood. This value was adjusted to 2018 dollars, which produced a value of $8,064, and was used to estimate clean-up costs in this study area for each building experiencing external damages.

In regards to alternative accommodation, the NSW OEH's recommended value of $220/week per household (inflated to $443 in 2018 dollars) was also used in this study. It was assumed that the duration of stay in alternate accommodation was proportional to the damage incurred by the building. As such, the following costs of alternate accommodation were used:

- Two weeks for buildings affected by inundation depths smaller than 300mm;
- Four weeks for buildings affected by inundation depths between 300mm and 900mm; and
- Six months (i.e. 26 weeks) for buildings affected by inundation depths exceeding 900mm.

For buildings affected by sea level rise or erosion, it was assumed that the damage was complete and permanent and a household relocation would be required. In this case, a household relocation cost of $2,000 was used as an indirect damage.

2.1.2 Non Residential Buildings

Using the GIS, the building dataset provided by Council was overlaid with the extent of the selected sea level rise, erosion and storm surge hazard scenarios to identify exposed non residential buildings. This exercise showed that overall 99 non-residential buildings are exposed to coastal hazards. Of these, 86 are commercial and 13 industrial. As previously noted, no schools, hospitals, or other types of non-residential buildings were identified as being at risk.

a) Direct Damages

i) Estimating the Exposed Value

The replacement value of non residential buildings was taken from a dataset developed by the Flood Hazard Research Centre (FHRC, 2013) at Middlesex University in the UK. While a potentially more accurate estimate of the value of Australian non residential buildings could have been possible, the values proposed by FHRC (2013) were adopted for consistency with the damage model selected, which were deemed the most suitable among those available globally. These are discussed in detail in the next section. The replacement costs of commercial and industrial buildings were then inflated to present day obtaining the following replacement costs, which include building structure and contents:

- Commercial buildings: \$2,241/m^2
- Industrial buildings: \$1,870/m^2

Similarly to what was done for residential buildings, the value of commercial land was extracted from recent real estate sale records and current listings. An average value of \$100/m^2 was used.

ii) Damage Models

Direct damages to commercial and industrial buildings were assessed using the following damage models:

Sea Level Rise and Erosion

Non-residential buildings affected by sea level rise or erosion were assumed to be totally and permanently lost. The damage was obtained by summing the estimated building and land value.

Storm Surge

At the time this CHAS was undertaken, there was no adopted industry standard suite of stage-damage curves for calculating direct commercial and industrial flood damages in Australia.

The most widely adopted stage-damage functions in Australia were those developed for the ANUFLOOD model, developed in 1983 and revised in 1994. Many studies have used the ANUFLOOD functions with adjustment factors to derive current values, based on CPI or AWE inflation.

Other studies in Australia adopted the FLDAMAGE model developed by Water Studies in 1992. FLDAMAGE is similar to ANUFLOOD in that it derives an estimate of total flood damages for inundated buildings by applying stage-damage curves appropriate to each type of property.

Both of these sets of stage damage curves were derived from data collected following Australian floods in the 1970s and 1980s when the contents of commercial and industrial premises were very different to today.

An international literature search showed that the most up to date stage damage curves have been developed by the Flood Hazard Research Centre (FHRC, 2013) at Middlesex University in the UK. These stage-damage curves are based on field observations made in the UK between 2003 and 2005. As such, they provide a contemporary evaluation of the damage to buildings and building contents. They are referred to as FLOODSite MCM.

The relevant stage damage curves for commercial and industrial buildings are shown in Figure 4.

The commercial and industrial curves were derived from average values across the full range of MCM commercial and industrial curves respectively. The original MCM curves were converted to Australian dollars and adjusted to 2018 values.

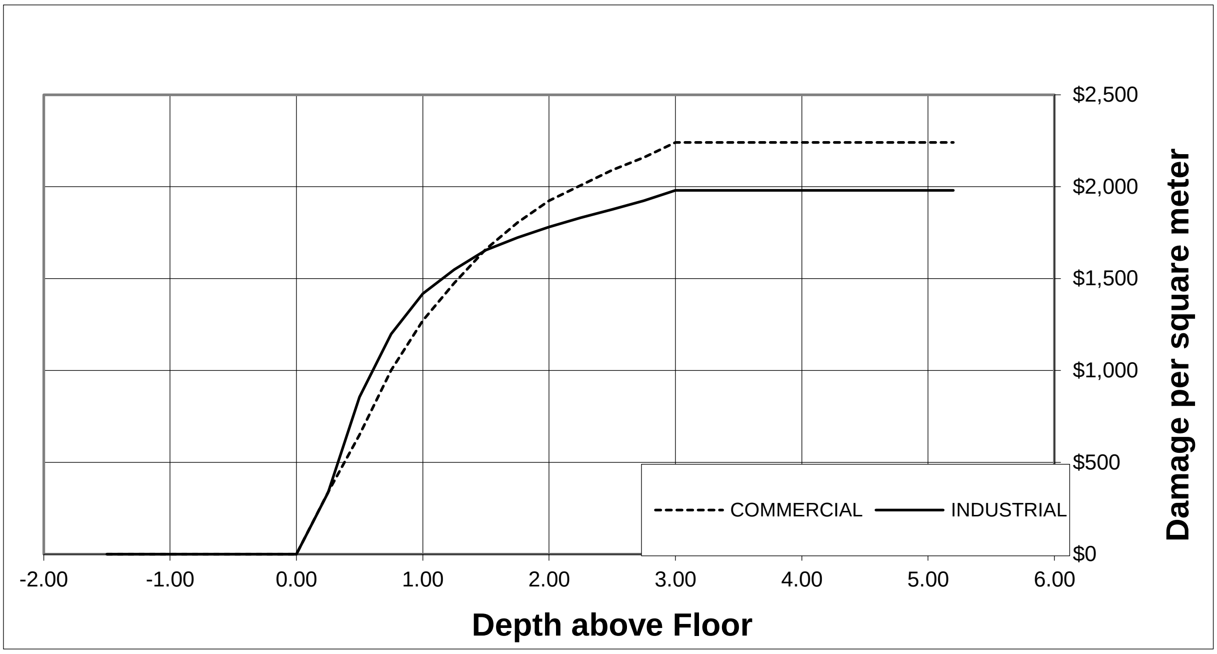

Figure 3. Non-residential stage damage curves

b) Indirect Damages

Indirect damages to non residential buildings include:

- removal and storage costs;
- clean-up costs;
- payments to workforce for unproductive work ;
- extra payments to the workforce (e.g. additional staff or overtime) to make up for lost production or to maintain production;
- costs of transferring production including use of alternative premises or less efficient plant, equipment or systems;
- long term efficiency losses;
- losses to customers;
- loss of production in businesses not affected by the hazards due to interruption of workforce, supplies or sales;
- downturn in trade due to changed regional expenditure patterns caused by the hazards;
- loss of business confidence through cancellation of contracts;
- loss of market position and possible closure of business.

There are several methods which have been suggested to estimate indirect commercial and industrial damages, either in part or in aggregate.

The Bureau of Transport Economics (BTE, 2001) cites NRC (1999) as international evidence that indirect costs increase as a proportion of total disaster costs with the size of disaster. It also notes that estimation of indirect damages as a percentage of total direct damages is common but varies widely as there is no simple relationship between the two types of damages.

In a review of flood damages research undertaken for the Warragamba Flood Mitigation Dam EIS (Sydney Water, 1995), indirect damages for commercial and industrial properties ranged from 25% to 150% of direct damages, depending on the type of business and flooding severity.

QNRM (2002) recommends the ANUFLOOD model estimations of indirect commercial damages as 55% of direct commercial damages. Bewsher Consulting (2003) cites studies that suggest an estimate for indirect commercial/industrial damages as 5% of actual direct damage for every day of trading that is lost. In later studies, Bewsher Consulting (2011a & b) calculated the indirect commercial damages as 20% of direct commercial damages.

In contrast to residential clean-up costs, the clean-up costs for commercial and industrial damages are estimated by BTE (2001) as ranging between $2,000 and $10,000 (in 1999 dollars) and clean-up times to be between only 1 and 3 days.

Reese and Ramsay (2010) estimate clean-up costs for commercial and industrial buildings by multiplying clean-up time by an hourly labour rate ($80/hr and $45/hr respectively).

Disruption to business involves the estimation of value added foregone, or loss in profits, not including the value of lost sales or stock (EMA, 2002; BTE, 2001; QNRM, 2002). This value is influenced by the length of disruption, whether the business can be transferred within or beyond the affected area and availability of alternative resources (BTE, 2001; Scawthorn et al., 2006). Smith (1979) estimated the cost of lost business accounting for 67% of indirect commercial damages and 71% of indirect industrial damages.

Reese and Ramsay (2010) measure business disruption by functional downtime and loss of income. Functional downtime is assessed as the time (in days) the business cannot operate and is scaled according to a building damage threshold of 10%. Loss of income is ascertained by determining daily income per employee.

Given the number and diverse types of commercial and industrial premises across the study area it is not practical to estimate functional downtime and loss of income per business therefore the indirect losses have been estimated as a percentage of direct losses.

As such, consistently with Bewsher Consulting (2011a and b), indirect damages for commercial premises were estimated as 20% of the direct costs. This proportion was increased to 50% for industrial buildings as many have specialist equipment which is not quickly replaceable.

2.1.3 Infrastructure

Damage estimates

In most floodplain risk management studies, direct and indirect damages to infrastructure are assessed as a proportion of the total damage to residential and non-residential buildings, typically 15%.

While this is overall a suitable approach being based on the damage recorded in historical disasters, it does not allow pinpointing the different value of specific assets. These may include infrastructure providing critical services to an entire community, part of which may be outside the area directly affected by the hazards.

The vulnerability assessment exercise identified the assets at each key location that are of particular significance. The impacts on these assets is discussed in detail in the next section. However, due to the lack of validated damage models for different infrastructure types, some of which are highly specific, and the partial lack of replacement cost data, damages to these assets could not be reliably quantified in monetary terms as it was done for residential and non-residential buildings.

As such, this study quantified **overall damages to infrastructure as a proportion (i.e. 15%)** of the total building damages. The resulting estimate is to be interpreted in conjunction with the qualitative analysis of impacts on critical assets provided in next section.

2.2 SOCIAL RISK

Social risk includes risk to life as well as other critically important intangibles risks such as:

- People's well-being, including mental health;
- Community identity and cohesion;
- Loss of memorabilia and items of sentimental value.

Risk to life was assessed by estimating the number and spatial distribution of Population At Risk (PAR). This was defined as the population located within areas exposed to potentially life threatening short-term hazard events.

As such, it was assumed that there would be no risk to life from sea level rise or erosion, because in these instances building occupants will be able leave the premises before these experience any significant structural instability.

With regard to storm surge inundation, a measure of the potential damage that floodwaters can cause to life, as well as property, is given by the "flood hazard". Flood hazard is obtained as the product between flow velocity and depth. AIDR (2017) provides six levels of hazard, ranging from H1 (no restrictions), to H6 (not suitable for people, vehicles or buildings)(Figure 4).

While the storm surge modelling undertaken as part of Phase 3 provided an estimate of the peak inundation depth, flow velocity was not available and consequently flood hazard could not be calculated. It was therefore assumed that a minimum inundation depth of 150mm would be required to pose a threat to life. Figure 4 shows that this depth threshold, if combined with flow velocities of about 2m/s, can pose a risk to small cars and pedestrians. In storm surges generating high-velocity flows, velocities do not typically exceed 2 to 3 m/s (Matias et al., 2010).

Broad population vulnerability mapping was achieved by assuming an average of 2.6 residents per dwelling (ABS, 2016). For commercial and industrial buildings, the number of occupants was estimated by counting the number of car parking spaces in recent high resolution aerial imagery and assuming an average of 1.5 people per car space, under the worst case scenario in which all car park spaces are occupied at the time the hazard occurs.

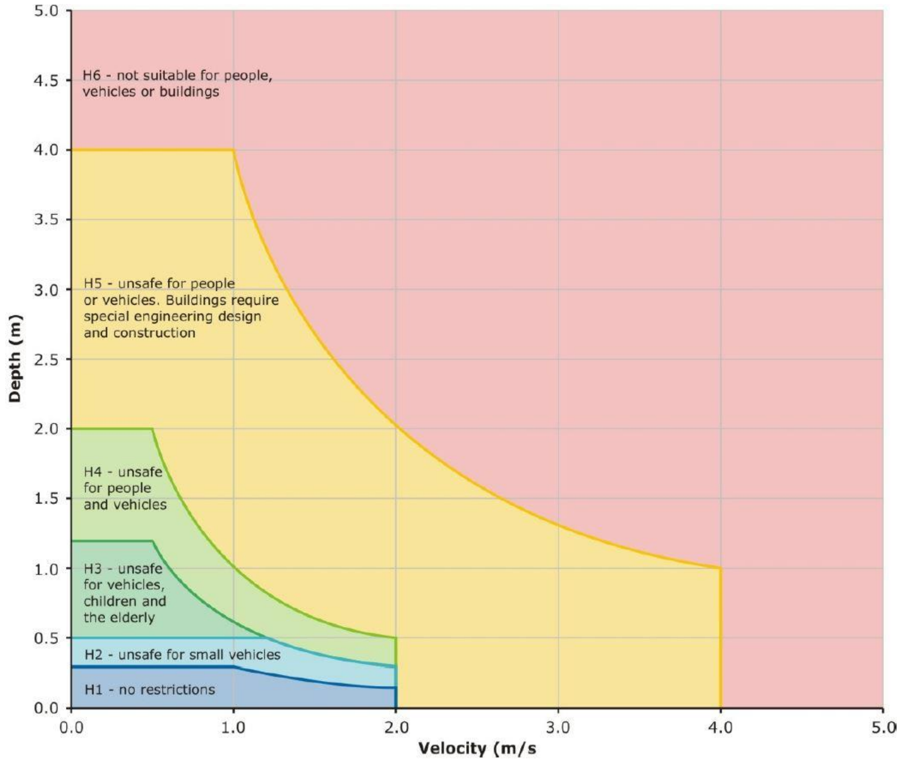

Figure 4. Provisional flood hazard categories (AIDR, 2017)

Social risks to other aspects of the community are more difficult to quantify. Attempts have been made in some floodplain risk management studies to include a tangible estimate (sometimes 20-25% of total residential and commercial/ industrial damages) in attempt to measure intangible, social damages. Consistently with this work, this study estimated social/intangible damage to be 25% of total residential and commercial/industrial damages.

2.3 ENVIRONMENTAL RISK

Environmental Risk was assessed by overlaying the outputs of the environmental vulnerability assessment (undertaken by frc Environmental and Meridian Urban, 2019) and the extent and of coastal hazards. As the vulnerability assessment exercise provided an index-based measure of the environmental value and sensitivity of the coastal ecosystems to different hazard types, risk was also assessed using an index-based approach.

2.4 ECONOMIC ANALYSIS

As per the Minimum Standards and Guidelines for Developing a CHAS (State of Queensland, 2016), a socio-economic appraisal of any potential adaptation options is to be undertaken to demonstrate their economic feasibility and profitability. This is to be done as part of Phase 7 of this CHAS through a cost –benefit analysis, comparing the costs of implementation and maintenance of any adaptation options against the benefits these provide in terms of reduction of present and future damages from coastal hazards.

The cost-benefit analysis requires therefore that present and future costs and benefits are discounted to present time figures, in a way that takes into account the probability of occurrence of hazard events, under the selected range of initial sea level conditions.

For each hazard type, this was achieved by estimating the expected damages throughout the next 80 years, and discounting these to present time by calculating the Present Value (PV) of the losses they will cause. The time horizon of 80 years was chosen because sea level was assumed to rise at a rate of 1cm per year. This time scale is also consistent with the expected life span of any structural risk reduction measures.

The PV is the sum of all future damages that can be expected over a fixed period (i.e. 80 years in this study) expressed as a cost in today's dollars. The present value is determined by discounting the future flood damage costs back to the present day situation, using a discount rate. In this study we adopted a discount rate of 7%.

The permanency, probability and time horizon of each of the three types of damages varies and must be accounted for differently. The following sets out how the annual damages from each were estimated and summed to create a present value.

2.4.1 Sea Level Rise Damage

Four sea level rise scenarios were modelled:

- Current conditions;
- 0.2m of sea level rise;
- 0.4m of sea level rise;
- 0.8m of sea level rise.

It was found that even under existing conditions some assets were damaged by the high astronomical tide so this was determined to be the present day cost of existing sea level. As sea level rise is a permanent change which increases over time, anything which falls below the HAT level can be considered permanently lost from the time that occurs. The total damages due to sea level rise were therefore estimated for 20cm (year 2040), 40cm (year 2060) and 80cm (year 2100).

Using the current damages and these future totals the annual incremental damage from sea level rise could then be interpolated for each year. The present value of each increment was then calculated based on the year it will occur in the future. These present values were all summed to estimate the present value of the damages caused by all of the future sea level rise.

2.4.2 Storm Surge Damage

For hazard types, such as storm surge, that over time tend to cause periodical damages to the same assets, an economic appraisal will require calculating the hazard's Annual Average Damages (AAD). AAD is a measure of the cost of storm surge inundation damage that could be expected each year by the community, on average. When applicable, AAD is a convenient yardstick to compare the economic benefits of various proposed mitigation measures with each other and the existing situation. Figure 5 describes how AAD relates to actual losses recorded over a long period. For the current study, AAD was assessed using the potential damages derived for each AEP storm event, under the assumption that there would be no flood damages in events as frequent as the 50% AEP.

AAD estimates are based on the assumption that after each storm event, the damaged assets would be repaired or rebuilt and brought back to the same condition they were before the disaster.

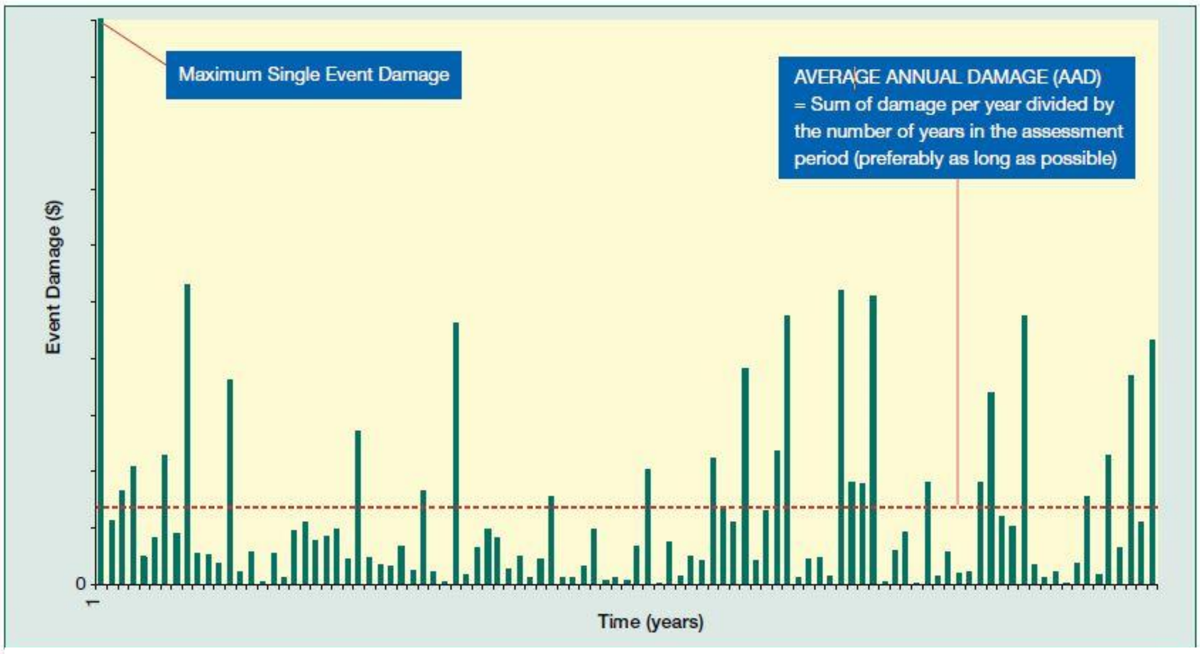

Figure 5. Randomly occurring flood damage as annual average damage (HNFMSC, 2006)

In this study there was the added complication that storm surge damages will change over time because of changes in sea level. For this reason the following approach was taken.

Firstly, in each storm surge event for each future sea level rise scenario, only that component of damage attributable to storm surge was estimated. That is, the permanent damages caused by the permanent change in sea level was excluded.

Secondly, the AADs were estimated for the suite of storm surge events in each of the four sea level rise scenarios. This provided an AAD for 2020, 2040, 2060 and 2100.

Thirdly, these were interpolated linearly to estimate an AAD for each year between now and 2100.

Finally, as with the sea level rise damages for each year, each year's AAD was discounted to a PV and then all of the PVs summed to get a total PV for storm surge which takes into account how AADs vary over time.

2.4.3 Erosion Damage

As with sea level rise, the losses from coastal erosion were assumed to be permanent however, there is also a probabilistic component as to whether they are experienced or not during the planning horizon. The permanency of the damage means that AAD is not a meaningful way of measuring annual damages from erosion. Furthermore, once one erosion event occurs, any damage from the next erosion event will be diminished by the damage caused by the previous event. For these reasons the following approach was taken.

Within each sea level rise scenario, the loss from each coastal erosion event (5%, 2% and 1% AEP) were estimated as the incremental damage over and above that caused by the permanent sea level rise for that scenario., As the losses from a 1% AEP event are greater than those of a 2% AEP event which in turn are greater than those of the 5% AEP event, the incremental losses from no event to 5% AEP, from 5% AEP to 2% AEP and from 2% AEP to 1% AEP were estimated.

Because an 80 year planning horizon was used, the probability of each of those events occurring within that time period was estimated and the incremental loss of the event was multiplied by that probability. For example, the 5% AEP event only has a $1-(1-1/20)^{80}$= 98% chance of occurring over the 80 years. If it were estimates that a 5% AEP erosion event would cause $1m worth of damage then a total loss of $980,000 was assigned to it. The 2% AEP event only has an 80% chance of occurring in 80 years and if it has a loss of $2m then its incremental loss is $1m over the 5% AEP event but because it might not occur, its incremental loss is reduced to $800,000. Similarly the 1% AEP event has only a 55% of occurring within the 80 year period to its incremental damages were reduced to this proportion.

To account for when the event might occur, it was assumed that the 5% AEP event would occur in the year by which there would be a 50/50 chance of it occurring i.e. after 13.5 years. Similarly it was assumed the 2% AEP event would occur in 34 years' time and the 1% AEP event in 68 years' time as that is when each has a 50/50 chance of occurring.

The erosion damage in year 13.5 was estimated by interpolating linearly between the erosion damage from a 5% event now and a 5% event in 20 years' time. The erosion damage in year 34 was estimated by interpolating between 2040 and 2060, the incremental erosion damage from the 2% event above the 5% event. In a similar way the difference between the 1% and 2% events in 2060 and 2100 were calculated and interpolated to estimate an incremental damage in year 68 (2088).

Each of these three damages were then brought to an NPV by discounting them from the year in which they were assumed to occur. The three NPVs were then summed to obtain a total NPV from erosion.

3 RESULTS

3.1 SUMMARY

As suggested by State of Queensland (2016), the outcomes of the risk assessment exercise were organised as follows:

- **Economic Risk**, including tangible damages estimates to infrastructure, residential and non residential buildings. Tangible damages include direct and indirect damages. These were estimated as absolute figures (i.e. damages in dollars) and in relative terms (i.e. proportion of damages incurred in each scenario calculated with respect to the total value of infrastructure, residential and non residential buildings at risk in the worst case scenario);
- **Social Risk**, including intangible damages and risk to life. Similarly to Economic Risk, Social Risk was assessed with absolute figures (i.e. damages in dollars, and number of people at risk), and relative terms (i.e. proportion of intangible damages incurred in each scenario calculated with respect to the total intangible value at risk in the worst case scenario, and proportion of people at risk in each scenario with respect to the total number of people at risk in the worst case scenario);
- **Environmental Risk**, impacts to coastal ecosystems of significant ecological, conservational or biodiversity value were assessed by proportioning the range and scale of the ecosystem types impacted combined with the ability of ecosystem to recover from coastal hazard events and the sensitivity of the ecosystem assigned within the vulnerability assessment (undertaken by frc Environmental and Meridian Urban)

The risk assessment results were used to classify the level of consequences (economic, social and environmental) for each sea level scenario and each AEP hazard event in the following categories:

- Catastrophic;
- Major;
- Moderate;
- Minor;
- Insignificant.

Table 3 shows the thresholds adopted for the above listed categories:

Table 3. Thresholds used to define risk consequence categories

	Insignificant	Minor	Moderate	Major	Catastrophic
Economic Risk	Total tangible damages <$250,000	Total tangible damages >$250,000	Total tangible damages >$1,000,000	Total tangible damages >$10,000,000	Total tangible damages >$100,000,000
Social Risk	Summed proportion of intangible damage and people at risk <20%	Summed proportion of intangible damage and people at risk >20%	Summed proportion of intangible damage and people at risk >50%	Summed proportion of intangible damage and people at risk >70%	Summed proportion of intangible damage and people at risk >90%
Environmental Risk	Rating <40	Rating 40 – 80	Rating 80 – 120	Rating 120 – 160	Rating >160

When interpreting the results, the following assumptions should be taken into account:

Results were summarised for each coastal settlement, including all possible permutations of risk types (Economic, Social, Environmental), hazard types (storm surge and erosion), and sea level conditions (i.e. current sea level, 0.2m increase, 0.4m increase and 0.8m increase). Each table provides damage figures for each AEP event of the relevant hazard type, as well as the relevant consequence category assigned according to Table 3.

Consistent with State of Queensland (2016), Risk Levels were obtained by merging probability and consequences of each event as shown in Table 4.

Table 4. Matrix of Likelihood and Consequences used to assign Risk Levels (State of Queensland, 2016)

		Consequences				
		Insignificant	**Minor**	**Moderate**	**Major**	**Catastrophic**
Likelihood	**Likely (5% AEP)**	Low	Medium	High	Extreme	Extreme
	Possible (2% AEP)	Low	Medium	High	High	Extreme
	Unlikely (1% AEP)	Low	Medium	Medium	High	Extreme
	Rare (0.2% AEP)	Low	Low	Medium	Medium	High

- A summary of the Net Present Value (NPV) of Economic Risk for each location, provided as a bar-chart (Figure 6).

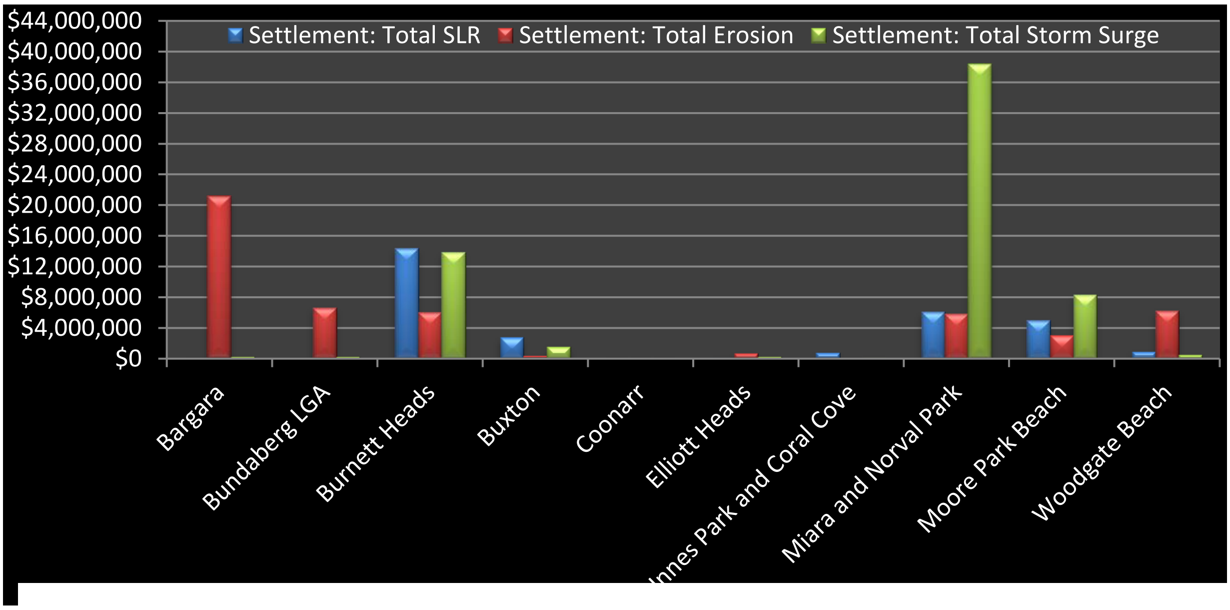

Figure 6. Summary of Net Present Value of Economic Risk across all coastal settlements (time horizons of 80 years)

3.2 ASSUMPTIONS AND LIMITATIONS

The following assumptions and limitations should be taken in account when interpreting the results:

- All calculations are based on the hazard extents generated as part of Phase 3. All the underlying assumptions and limitations apply to the risk assessment results too;
- The risk assessment model did not calculate any damages from erosion or storm surge for buildings affected by sea level rise. These buildings were assumed to be already totally and permanently damaged by the increase of sea level and as such no further damage was possible;
- Damages from storm surge are generally lower than damages from erosion, because in a storm surge the damage level was assumed to depend on the depth of inundation, whereas erosion was assumed to cause complete and permanent loss of the affected assets. However, the Net Present Value of damages from storm surges and erosion are comparable because damages from storm surges to the same building are assumed to occur repeatedly over the selected time frame (i.e. 80 years), while damages from coastal erosion were assumed to occur once only and cause permanent loss of that building.
- Minor model instabilities were observed for buildings located across the boundary of the storm inundation extent. The flood affectation of these buildings was inconsistently calculated by the GIS model due to the relatively small difference between the pixel size in the storm surge flood model, and the area of each building polygon. This inaccuracy has resulted in a number of cases in which total storm damages are higher in a lower sea level condition (e.g. current sea level in Bargara) than in a future increased sea level scenario (e.g. 0.2m sea level rise in Bargara), even though the number of buildings affected by sea level rise has not increased. Because this affects only buildings across the flood extent boundary, the resulting error is only noticeable when the total damages of that particular coastal settlement are relatively low.
- The logics underlying the selection of the Social Risk consequences is consistent with the CHAS minimum standards (State of Queensland, 2016), however the thresholds are subjective due to the inherent challenges of aggregating damages expressed as dollars (i.e. intangible damages) and number of people at risk.
- It should be noted that, as reported in Phase 3 of the CHAS, five key study locations were identified for further study and refinement of the coastal erosion extents:
    - Moore Park Beach
    - Bargara (Kellys Beach)
    - Innes Park
    - Coonarr
    - Woodgate Beach
- In these coastal settlements, coastal erosion is considered the dominant hazard and as such the risk assessment includes the economic, social and environmental consequences applied to the range of AEPs and sea level scenarios applied to the erosion prone areas.
- In all other locations, typically rocky foreshore or estuarine areas, the coastal erosion hazard extent is represented by the default erosion prone area width of the maximum of Highest Astronomical Tide (HAT) plus 40m inland or HAT plus 0.8m sea level rise in accordance with the QLD State Erosion Prone Area Mapping. The risk assessment includes the economic, social and environmental consequences applied to the 0.8m sea level rise scenario, to ensure the CHAS aligns with the State Planning Policy 2016 (SPP) specifically addressing the coastal hazard component of the State interest policy.

3.3 ECONOMIC DAMAGES AND RISK RATING

3.3.1 Miara and Norval Park

Storm Tide Inundation

SLR Scenario	AEP	Damages	Consequence Scale	Risk	Sensitivity: with semi-permanent structures
Current Sea Level	5%	$2,185,051	Moderate	High	$10,925,253
	2%	$2,481,896	Moderate	High	$12,409,479
	1%	$4,462,386	Moderate	Medium	$22,311,930
	0.2%	$5,554,056	Moderate	Medium	$27,770,281
0.2m	5%	$2,655,671	Moderate	High	$13,278,355
	2%	$2,994,582	Moderate	High	$14,972,909
	1%	$5,151,465	Moderate	Medium	$25,757,323
	0.2%	$8,497,195	Moderate	Medium	$42,485,975
0.4m	5%	$6,023,500	Moderate	High	$30,117,502
	2%	$6,357,687	Moderate	High	$31,788,435
	1%	$8,567,224	Moderate	Medium	$42,836,119
	0.2%	$11,663,922	Major	Medium	$58,319,608
0.8m	5%	$19,564,223	Major	Extreme	$97,821,113
	2%	$19,678,975	Major	High	$98,394,876
	1%	$21,351,688	Major	High	$106,758,439
	0.2%	$22,223,009	Major	Medium	$111,115,045

Coastal Erosion

SLR Scenario	AEP	Damages	Consequence Scale	Risk	Sensitivity: with semi-permanent structures
0.8m	5%	$29,005,323	Major	Extreme	$145,026,616
	2%	$29,005,323	Major	High	$145,026,616
	1%	$29,005,323	Major	High	$145,026,616

3.3.2 Moore Park Beach

Storm Tide Inundation

SLR Scenario	AEP	Damages	Consequence Scale	Risk
Current Sea Level	5%	$6,160,971	Moderate	High
	2%	$6,547,553	Moderate	High
	1%	$8,764,054	Moderate	Medium
	0.2%	$30,263,758	Major	Medium
0.2m	5%	$10,570,023	Major	Extreme
	2%	$10,740,026	Major	High
	1%	$13,230,483	Major	High
	0.2%	$37,124,152	Major	Medium
0.4m	5%	$15,200,303	Major	Extreme
	2%	$15,401,357	Major	High
	1%	$18,932,180	Major	High
	0.2%	$67,407,322	Major	Medium
0.8m	5%	$26,872,947	Major	Extreme
	2%	$27,436,380	Major	High
	1%	$41,602,838	Major	High
	0.2%	$140,481,687	Catastrophic	High

Coastal Erosion

SLR Scenario	AEP	Damages	Consequence Scale	Risk
Current Sea Level	5%	$6,140,127	Moderate	High
	2%	$6,140,127	Moderate	High
	1%	$6,140,127	Moderate	Medium
0.2m	5%	$20,032,749	Major	Extreme
	2%	$22,955,235	Major	High
	1%	$22,955,235	Major	High
0.4m	5%	$125,740,562	Catastrophic	Extreme
	2%	$127,609,473	Catastrophic	Extreme
	1%	$136,229,428	Catastrophic	Extreme
0.8m	5%	$343,599,436	Catastrophic	Extreme
	2%	$343,599,436	Catastrophic	Extreme
	1%	$346,783,063	Catastrophic	Extreme

3.3.3 Burnett Heads

Storm Tide Inundation

SLR Scenario	AEP	Damages	Consequence Scale	Risk
Current Sea Level	5%	$11,627,623	Major	Extreme
	2%	$11,813,151	Major	High
	1%	$18,056,247	Major	High
	0.2%	$34,486,783	Major	Medium
0.2m	5%	$23,417,230	Major	Extreme
	2%	$24,304,135	Major	High
	1%	$27,486,923	Major	High
	0.2%	$45,322,816	Major	Medium
0.4m	5%	$47,406,088	Major	Extreme
	2%	$48,437,176	Major	High
	1%	$51,413,284	Major	High
	0.2%	$73,254,453	Major	Medium
0.8m	5%	$109,605,357	Catastrophic	Extreme
	2%	$110,008,241	Catastrophic	Extreme
	1%	$118,294,531	Catastrophic	Extreme
	0.2%	$137,586,806	Catastrophic	High

Coastal Erosion

SLR Scenario	AEP	Damages	Consequence Scale	Risk
0.8m	5%	$183,163,181	Catastrophic	Extreme
	2%	$183,163,181	Catastrophic	Extreme
	1%	$183,163,181	Catastrophic	Extreme

3.3.4 Bargara

Storm Tide Inundation

SLR Scenario	AEP	Damages	Consequence Scale	Risk
Current Sea Level	5%	$98,064	Insignificant	Low
	2%	$98,064	Insignificant	Low
	1%	$268,067	Minor	Medium
	0.2%	$808,468	Minor	Low
0.2m	5%	$98,064	Insignificant	Low
	2%	$98,064	Insignificant	Low
	1%	$268,067	Minor	Medium
	0.2%	$808,468	Minor	Low
0.4m	5%	$98,064	Insignificant	Low
	2%	$98,064	Insignificant	Low
	1%	$268,067	Minor	Medium
	0.2%	$808,468	Minor	Low
0.8m	5%	$24,268,603	Major	Extreme
	2%	$24,578,334	Major	High
	1%	$26,432,863	Major	High
	0.2%	$45,771,851	Major	Medium

Coastal Erosion

SLR Scenario	AEP	Damages	Consequence Scale	Risk
0.8m	5%	$478,677,180	Catastrophic	Extreme
	2%	$478,677,180	Catastrophic	Extreme
	1%	$517,741,554	Catastrophic	Extreme

3.3.5 Kellys Beach (Bargara)

A sensitivity analysis has been undertaken for the coastal erosion hazard area of Kellys Beach.

Coastal Erosion				
SLR Scenario	AEP	Damages	Consequence Scale	Risk
Current Sea Level	5%	$31,521,539	Major	Extreme
	2%	$39,437,983	Major	High
	1%	$39,437,983	Major	High
0.2m	5%	$62,526,438	Major	Extreme
	2%	$64,304,270	Major	High
	1%	$64,304,270	Major	High
0.4m	5%	$83,404,345	Major	Extreme
	2%	$84,497,939	Major	High
	1%	$84,497,939	Major	High
0.8m	5%	$98,962,351	Major	Extreme
	2%	$98,962,351	Major	High
	1%	$98,962,351	Major	High

3.3.6 Innes Park and Coral Cove

Storm Tide Inundation				
SLR Scenario	AEP	Damages	Consequence Scale	Risk
Current Sea Level	5%	$0	Insignificant	Low
	2%	$0	Insignificant	Low
	1%	$0	Insignificant	Low
	0.2%	$452,279	Minor	Low
0.2m	5%	$46,576	Insignificant	Low
	2%	$46,576	Insignificant	Low
	1%	$77,627	Insignificant	Low
	0.2%	$333,610	Minor	Low
0.4m	5%	$4,492,465	Moderate	High
	2%	$4,523,516	Moderate	High
	1%	$4,523,516	Moderate	Medium
	0.2%	$4,686,666	Moderate	Medium
0.8m	5%	$8,708,491	Moderate	High
	2%	$8,708,491	Moderate	High
	1%	$8,708,491	Moderate	Medium
	0.2%	$8,909,545	Moderate	Medium

Coastal Erosion				
SLR Scenario	AEP	Damages	Consequence Scale	Risk
Current Sea Level	5%	$0	Insignificant	Low
	2%	$0	Insignificant	Low
	1%	$0	Insignificant	Low
0.2m	5%	$0	Insignificant	Low
	2%	$0	Insignificant	Low
	1%	$0	Insignificant	Low
0.4m	5%	$7,787,803	Moderate	High
	2%	$7,787,803	Moderate	High
	1%	$7,787,803	Moderate	Medium
0.8m	5%	$30,608,769	Moderate	High
	2%	$30,608,769	Moderate	High
	1%	$30,608,769	Moderate	Medium

3.3.7 Elliott Heads

Storm Tide Inundation				
SLR Scenario	AEP	Damages	Consequence Scale	Risk
Current Sea Level	5%	$113,590	Insignificant	Low
	2%	$113,590	Insignificant	Low
	1%	$283,592	Insignificant	Low
	0.2%	$1,041,231	Moderate	Medium
0.2m	5%	$113,590	Insignificant	Low
	2%	$113,590	Insignificant	Low
	1%	$283,592	Insignificant	Low
	0.2%	$1,041,231	Moderate	Medium
0.4m	5%	$931,623	Minor	Medium
	2%	$931,623	Minor	Medium
	1%	$1,101,625	Moderate	Medium
	0.2%	$1,859,263	Moderate	Medium
0.8m	5%	$2,429,111	Moderate	High
	2%	$2,429,111	Moderate	High
	1%	$2,599,114	Moderate	Medium
	0.2%	$3,587,486	Moderate	Medium

Coastal Erosion				
SLR Scenario	AEP	Damages	Consequence Scale	Risk
0.8m	5%	$23,416,369	Major	Extreme
	2%	$23,416,369	Major	High
	1%	$23,416,369	Major	High

3.3.8 Coonarr

Storm Tide Inundation				
SLR Scenario	AEP	Damages	Consequence Scale	Risk
Current Sea Level	5%	$0	Insignificant	Low
	2%	$0	Insignificant	Low
	1%	$0	Insignificant	Low
	0.2%	$0	Insignificant	Low
0.2m	5%	$0	Insignificant	Low
	2%	$0	Insignificant	Low
	1%	$15,525	Insignificant	Low
	0.2%	$15,525	Insignificant	Low
0.4m	5%	$0	Insignificant	Low
	2%	$0	Insignificant	Low
	1%	$15,525	Insignificant	Low
	0.2%	$15,525	Insignificant	Low
0.8m	5%	$588,033	Minor	Medium
	2%	$588,033	Minor	Medium
	1%	$588,033	Minor	Medium
	0.2%	$588,033	Minor	Low

Coastal Erosion				
SLR Scenario	AEP	Damages	Consequence Scale	Risk
Current Sea Level	5%	$0	Insignificant	Low
	2%	$0	Insignificant	Low
	1%	$0	Insignificant	Low
0.2m	5%	$1,375,332	Moderate	High
	2%	$1,375,332	Moderate	High
	1%	$1,793,911	Moderate	Medium
0.4m	5%	$8,969,556	Moderate	High
	2%	$8,969,556	Moderate	High
	1%	$9,870,983	Moderate	Medium
0.8m	5%	$9,557,589	Moderate	High
	2%	$9,557,589	Moderate	High
	1%	$9,557,589	Moderate	Medium

3.3.9 Woodgate Beach

Storm Tide Inundation

SLR Scenario	AEP	Damages	Consequence Scale	Risk
Current Sea Level	5%	$170,003	Insignificant	Low
	2%	$170,003	Insignificant	Low
	1%	$170,003	Insignificant	Low
	0.2%	$3,434,173	Moderate	Medium
0.2m	5%	$170,003	Insignificant	Low
	2%	$170,003	Insignificant	Low
	1%	$170,003	Insignificant	Low
	0.2%	$3,434,173	Moderate	Medium
0.4m	5%	$1,612,488	Moderate	High
	2%	$1,612,488	Moderate	High
	1%	$1,612,488	Moderate	Medium
	0.2%	$3,982,617	Moderate	Medium
0.8m	5%	$29,233,727	Major	Extreme
	2%	$29,233,727	Major	High
	1%	$29,935,561	Major	High
	0.2%	$39,115,744	Major	Medium

Coastal Erosion

SLR Scenario	AEP	Damages	Consequence Scale	Risk
Current Sea Level	5%	$0	Insignificant	Low
	2%	$0	Insignificant	Low
	1%	$0	Insignificant	Low
0.2m	5%	$26,081,760	Major	Extreme
	2%	$28,940,760	Major	High
	1%	$34,019,687	Major	High
0.4m	5%	$108,044,976	Catastrophic	Extreme
	2%	$108,044,976	Catastrophic	Extreme
	1%	$138,592,647	Catastrophic	Extreme
0.8m	5%	$347,763,440	Catastrophic	Extreme
	2%	$347,763,440	Catastrophic	Extreme
	1%	$386,827,814	Catastrophic	Extreme

3.3.10 Buxton

Storm Tide Inundation

SLR Scenario	AEP	Damages	Consequence Scale	Risk
Current Sea Level	5%	$598,236	Minor	Medium
	2%	$598,236	Minor	Medium
	1%	$598,236	Minor	Medium
	0.2%	$4,528,419	Moderate	Medium
0.2m	5%	$1,340,514	Moderate	High
	2%	$1,340,514	Moderate	High
	1%	$1,547,256	Moderate	Medium
	0.2%	$4,201,895	Moderate	Medium
0.4m	5%	$12,799,661	Major	Extreme
	2%	$12,825,481	Major	High
	1%	$12,856,531	Major	High
	0.2%	$15,004,467	Major	Medium
0.8m	5%	$28,282,279	Major	Extreme
	2%	$28,406,163	Major	High
	1%	$28,421,689	Major	High
	0.2%	$29,362,956	Major	Medium

Coastal Erosion

SLR Scenario	AEP	Damages	Consequence Scale	Risk
0.8m	5%	$40,624,531	Major	Extreme
	2%	$40,624,531	Major	High
	1%	$40,624,531	Major	High

3.4 SOCIAL CONSEQUENCES

3.4.1 Miara and Norval Park

Storm Tide Inundation

SLR Scenario	AEP	Proportion of total intangible values at risk	Proportion of total PAR	Total	Consequence Scale	Risk
Current Sea Level	5%	1.3%	21.8%	23.1%	Minor	Medium
	2%	1.5%	25.3%	26.7%	Minor	Medium
	1%	2.6%	49.5%	52.1%	Minor	Medium
	0.2%	3.3%	63.0%	66.3%	Moderate	Medium
0.2m	5%	2.0%	25.7%	27.7%	Minor	Medium
	2%	2.2%	28.3%	30.5%	Minor	Medium
	1%	3.8%	56.0%	59.8%	Minor	Medium
	0.2%	6.3%	68.2%	74.5%	Major	Medium
0.4m	5%	3.6%	34.0%	37.5%	Minor	Medium
	2%	3.8%	38.8%	42.5%	Minor	Medium
	1%	5.1%	57.8%	62.8%	Moderate	Medium
	0.2%	6.9%	74.3%	81.2%	Major	Medium
0.8m	5%	11.5%	34.0%	45.5%	Minor	Medium
	2%	11.6%	38.8%	50.4%	Moderate	High
	1%	12.6%	57.8%	70.4%	Major	High
	0.2%	13.1%	74.3%	87.4%	Major	Medium

Coastal Erosion

SLR Scenario	AEP	Proportion of total intangible values at risk	Proportion of total PAR	Total	Consequence Scale	Risk
0.8m	5%	68.3%	0.0%	68.3%	Moderate	High
	2%	68.3%	0.0%	68.3%	Moderate	High
	1%	68.3%	0.0%	68.3%	Moderate	Medium

3.4.2 Moore Park Beach

Storm Tide Inundation

SLR Scenario	AEP	Proportion of total intangible values at risk	Proportion of total PAR	Total	Consequence Scale	Risk
Current Sea Level	5%	0.8%	1.5%	2.3%	Insignificant	Low
	2%	0.8%	1.8%	2.7%	Insignificant	Low
	1%	1.1%	3.3%	4.4%	Insignificant	Low
	0.2%	3.9%	24.9%	28.8%	Moderate	Medium
0.2m	5%	1.4%	1.0%	2.3%	Insignificant	Low
	2%	1.4%	1.0%	2.3%	Insignificant	Low
	1%	1.7%	3.6%	5.3%	Insignificant	Low
	0.2%	4.8%	41.7%	46.4%	Minor	Low
0.4m	5%	2.0%	1.4%	3.3%	Insignificant	Low
	2%	2.0%	1.6%	3.6%	Insignificant	Low
	1%	2.4%	7.8%	10.2%	Insignificant	Low
	0.2%	8.7%	59.4%	68.1%	Moderate	Medium
0.8m	5%	3.5%	3.0%	6.4%	Insignificant	Low
	2%	3.5%	6.1%	9.6%	Insignificant	Low
	1%	5.4%	28.9%	34.2%	Minor	Medium
	0.2%	18%	82%	100%	Catastrophic	High

Coastal Erosion

SLR Scenario	AEP	Proportion of total intangible values at risk	Proportion of total PAR	Potentially Isolated Communities	Total	Consequence Scale	Risk
Current Sea Level	5%	0.7%	0.0%	N/A	0.7%	Insignificant	Low
	2%	0.7%	0.0%		0.7%	Insignificant	Low
	1%	0.7%	0.0%		0.7%	Insignificant	Low
0.2m	5%	2.6%	0.0%	N/A	2.6%	Insignificant	Low
	2%	2.6%	0.0%		2.6%	Insignificant	Low
	1%	2.6%	0.0%		2.6%	Insignificant	Low
0.4m	5%	12.9%	0.0%	Regular inundation of key access routes	12.9%	Major	Extreme
	2%	13.0%	0.0%		13.0%	Major	High
	1%	13.9%	0.0%		13.9%	Major	High
0.8m	5%	34.7%	0.0%	Isolation	34.7%	Catastrophic	Extreme
	2%	34.7%	0.0%		34.7%	Catastrophic	Extreme
	1%	35.0%	0.0%		35.0%	Catastrophic	Extreme

3.4.3 Burnett Heads

Storm Tide Inundation

SLR Scenario	AEP	Proportion of total intangible values at risk	Proportion of total PAR	Total	Consequence Scale	Risk
Current Sea Level	5%	3.4%	6.0%	9.5%	Insignificant	Low
	2%	3.5%	6.5%	10.0%	Insignificant	Low
	1%	5.4%	16.9%	22.2%	Minor	Medium
	0.2%	10.2%	48.7%	58.9%	Moderate	Medium
0.2m	5%	6.9%	3.3%	10.3%	Insignificant	Low
	2%	7.2%	6.0%	13.2%	Insignificant	Low
	1%	8.1%	15.1%	23.2%	Minor	Medium
	0.2%	13.4%	51.2%	64.6%	Moderate	Medium
0.4m	5%	14.1%	5.1%	19.2%	Insignificant	Low
	2%	14.4%	7.6%	21.9%	Minor	Medium
	1%	15.2%	21.1%	36.4%	Moderate	Medium
	0.2%	21.7%	59.6%	81.3%	Major	Medium
0.8m	5%	32.5%	6.4%	38.9%	Moderate	High
	2%	32.6%	9.8%	42.4%	Moderate	High
	1%	35.1%	29.5%	64.6%	Major	High
	0.2%	40%	60%	100%	Catastrophic	High

Coastal Erosion

SLR Scenario	AEP	Proportion of total intangible values at risk	Proportion of total PAR	Total	Consequence Scale	Risk
0.8m	5%	49.1%	0.0%	49.1%	Minor	Medium
	2%	49.1%	0.0%	49.1%	Minor	Medium
	1%	49.1%	0.0%	49.1%	Minor	Medium

3.4.4 Bargara

Storm Tide Inundation						
SLR Scenario	**AEP**	**Proportion of total intangible values at risk**	**Proportion of total PAR**	**Total**	**Consequence Scale**	**Risk**
Current Sea Level	5%	0.0%	0.0%	0.0%	Insignificant	Low
	2%	0.0%	0.0%	0.0%	Insignificant	Low
	1%	0.1%	0.0%	0.1%	Insignificant	Low
	0.2%	0.2%	1.0%	1.2%	Insignificant	Low
0.2m	5%	0.0%	0.0%	0.0%	Insignificant	Low
	2%	0.0%	0.0%	0.0%	Insignificant	Low
	1%	0.1%	0.0%	0.1%	Insignificant	Low
	0.2%	0.2%	6.2%	6.4%	Insignificant	Low
0.4m	5%	0.0%	0.0%	0.0%	Insignificant	Low
	2%	0.0%	0.0%	0.0%	Insignificant	Low
	1%	0.1%	0.3%	0.4%	Insignificant	Low
	0.2%	0.2%	22.5%	22.8%	Minor	Low
0.8m	5%	3.4%	0.0%	3.4%	Insignificant	Low
	2%	3.5%	1.5%	5.0%	Insignificant	Low
	1%	3.7%	10.8%	14.5%	Insignificant	Low
	0.2%	6.5%	50.0%	56.5%	Moderate	Medium

Coastal Erosion						
SLR Scenario	**AEP**	**Proportion of total intangible values at risk**	**Proportion of total PAR**	**Total**	**Consequence Scale**	**Risk**
0.8m	5%	52.5%	0.0%	52.5%	Moderate	High
	2%	52.5%	0.0%	52.5%	Moderate	High
	1%	56.8%	0.0%	56.8%	Moderate	Medium

3.4.5 Kellys Beach (Bargara)

A sensitivity analysis has been undertaken for the coastal erosion hazard area of Kellys Beach.

Coastal Erosion						
SLR Scenario	**AEP**	**Proportion of total intangible values at risk**	**Proportion of total PAR**	**Total**	**Consequence Scale**	**Risk**
Current Sea Level	5%	25.5%	0.0%	25.5%	Minor	Medium
	2%	31.9%	0.0%	31.9%	Minor	Medium
	1%	31.9%	0.0%	31.9%	Minor	Medium
0.2m	5%	50.6%	0.0%	50.6%	Moderate	High
	2%	52.1%	0.0%	52.1%	Moderate	High
	1%	52.1%	0.0%	52.1%	Moderate	Medium
0.4m	5%	67.6%	0.0%	67.6%	Moderate	High
	2%	68.4%	0.0%	68.4%	Moderate	High
	1%	68.4%	0.0%	68.4%	Moderate	Medium
0.8m	5%	80.2%	0.0%	80.2%	Major	Extreme
	2%	80.2%	0.0%	80.2%	Major	High
	1%	80.2%	0.0%	80.2%	Major	High

3.4.6 Innes Park and Coral Cove

Storm Tide Inundation

SLR Scenario	AEP	Proportion of total intangible values at risk	Proportion of total PAR	Total	Consequence Scale	Risk
Current Sea Level	5%	0.0%	0.0%	0.0%	Insignificant	Low
	2%	0.0%	0.0%	0.0%	Insignificant	Low
	1%	0.0%	0.0%	0.0%	Insignificant	Low
	0.2%	1.7%	20.8%	22.6%	Minor	Low
0.2m	5%	0.2%	12.5%	12.7%	Insignificant	Low
	2%	0.2%	12.5%	12.7%	Insignificant	Low
	1%	0.3%	20.8%	21.1%	Minor	Medium
	0.2%	1.3%	33.3%	34.6%	Minor	Low
0.4m	5%	17.1%	0.0%	17.1%	Insignificant	Low
	2%	17.2%	8.3%	25.5%	Minor	Medium
	1%	17.2%	8.3%	25.5%	Minor	Medium
	0.2%	17.8%	25.0%	42.8%	Minor	Low
0.8m	5%	33.1%	0.0%	33.1%	Minor	Medium
	2%	33.1%	0.0%	33.1%	Minor	Medium
	1%	33.1%	0.0%	33.1%	Minor	Medium
	0.2%	33.9%	8.3%	42.2%	Minor	Low

Coastal Erosion

SLR Scenario	AEP	Proportion of total intangible values at risk	Proportion of total PAR	Total	Consequence Scale	Risk
Current Sea Level	5%	0.0%	0.0%	0.0%	Insignificant	Low
	2%	0.0%	0.0%	0.0%	Insignificant	Low
	1%	0.0%	0.0%	0.0%	Insignificant	Low
0.2m	5%	0.0%	0.0%	0.0%	Insignificant	Low
	2%	0.0%	0.0%	0.0%	Insignificant	Low
	1%	0.0%	0.0%	0.0%	Insignificant	Low
0.4m	5%	26.7%	0.0%	26.7%	Minor	Medium
	2%	26.7%	0.0%	26.7%	Minor	Medium
	1%	26.7%	0.0%	26.7%	Minor	Medium
0.8m	5%	97.0%	0.0%	97.0%	Catastrophic	Extreme
	2%	97.0%	0.0%	97.0%	Catastrophic	Extreme
	1%	97.0%	0.0%	97.0%	Catastrophic	Extreme

3.4.7 Elliott Heads

Storm Tide Inundation

SLR Scenario	AEP	Proportion of total intangible values at risk	Proportion of total PAR	Total	Consequence Scale	Risk
Current Sea Level	5%	0.3%	3.4%	3.7%	Insignificant	Low
	2%	0.3%	3.4%	3.7%	Insignificant	Low
	1%	0.8%	3.4%	4.2%	Insignificant	Low
	0.2%	2.8%	13.7%	16.5%	Insignificant	Low
0.2m	5%	0.3%	0.0%	0.3%	Insignificant	Low
	2%	0.3%	0.0%	0.3%	Insignificant	Low
	1%	0.8%	0.0%	0.8%	Insignificant	Low
	0.2%	2.8%	17.1%	19.9%	Insignificant	Low
0.4m	5%	2.5%	0.0%	2.5%	Insignificant	Low
	2%	2.5%	0.0%	2.5%	Insignificant	Low
	1%	3.0%	0.0%	3.0%	Insignificant	Low
	0.2%	5.1%	13.7%	18.8%	Insignificant	Low
0.8m	5%	6.6%	0.0%	6.6%	Insignificant	Low
	2%	6.6%	0.0%	6.6%	Insignificant	Low
	1%	7.1%	0.0%	7.1%	Insignificant	Low
	0.2%	9.8%	43.7%	53.5%	Moderate	Medium

Coastal Erosion

SLR Scenario	AEP	Proportion of total intangible values at risk	Proportion of total PAR	Total	Consequence Scale	Risk
0.8m	5%	50.5%	0.0%	50.5%	Moderate	High
	2%	50.5%	0.0%	50.5%	Moderate	High
	1%	50.5%	0.0%	50.5%	Moderate	Medium

3.4.8 Coonarr

Storm Tide Inundation

SLR Scenario	AEP	Proportion of total intangible values at risk	Proportion of total PAR	Total	Consequence Scale	Risk
Current Sea Level	5%	0.0%	0.0%	0.0%	Insignificant	Low
	2%	0.0%	0.0%	0.0%	Insignificant	Low
	1%	0.0%	0.0%	0.0%	Insignificant	Low
	0.2%	0.0%	0.0%	0.0%	Insignificant	Low
0.2m	5%	0.0%	0.0%	0.0%	Insignificant	Low
	2%	0.0%	0.0%	0.0%	Insignificant	Low
	1%	0.2%	0.0%	0.2%	Insignificant	Low
	0.2%	0.2%	16.7%	16.9%	Insignificant	Low
0.4m	5%	0.0%	0.0%	0.0%	Insignificant	Low
	2%	0.0%	0.0%	0.0%	Insignificant	Low
	1%	0.2%	0.0%	0.2%	Insignificant	Low
	0.2%	0.2%	16.7%	16.9%	Insignificant	Low
0.8m	5%	7.8%	0.0%	7.8%	Insignificant	Low
	2%	7.8%	0.0%	7.8%	Insignificant	Low
	1%	7.8%	0.0%	7.8%	Insignificant	Low
	0.2%	7.8%	0.0%	7.8%	Insignificant	Low

Coastal Erosion

SLR Scenario	AEP	Proportion of total intangible values at risk	Proportion of total PAR	Potentially Isolated Communities	Total	Consequence Scale	Risk
Current Sea Level	5%	0.0%	0.0%	N/A	0.0%	Insignificant	Low
	2%	0.0%	0.0%		0.0%	Insignificant	Low
	1%	0.0%	0.0%		0.0%	Insignificant	Low
0.2m	5%	0.0%	0.0%	Isolation	0.0%	Catastrophic	Extreme
	2%	0.0%	0.0%		0.0%	Catastrophic	Extreme
	1%	18.2%	0.0%		18.2%	Catastrophic	Extreme
0.4m	5%	91.0%	0.0%	Isolation	91.0%	Catastrophic	Extreme
	2%	91.0%	0.0%		91.0%	Catastrophic	Extreme
	1%	100%	0.0%		100%	Catastrophic	Extreme
0.8m	5%	98.8%	0.0%	Isolation	98.8%	Catastrophic	Extreme
	2%	98.8%	0.0%		98.8%	Catastrophic	Extreme
	1%	98.8%	0.0%		98.8%	Catastrophic	Extreme

3.4.9 Woodgate Beach

Storm Tide Inundation

SLR Scenario	AEP	Proportion of total intangible values at risk	Proportion of total PAR	Total	Consequence Scale	Risk
Current Sea Level	5%	0.0%	0.0%	0.0%	Insignificant	Low
	2%	0.0%	0.0%	0.0%	Insignificant	Low
	1%	0.0%	0.0%	0.0%	Insignificant	Low
	0.2%	0.9%	7.0%	7.9%	Insignificant	Low
0.2m	5%	0.0%	0.0%	0.0%	Insignificant	Low
	2%	0.0%	0.0%	0.0%	Insignificant	Low
	1%	0.0%	0.3%	0.4%	Insignificant	Low
	0.2%	0.9%	9.0%	9.9%	Insignificant	Low
0.4m	5%	0.4%	0.0%	0.4%	Insignificant	Low
	2%	0.4%	0.0%	0.4%	Insignificant	Low
	1%	0.4%	0.0%	0.4%	Insignificant	Low
	0.2%	1.0%	14.4%	15.4%	Insignificant	Low
0.8m	5%	7.5%	0.0%	7.5%	Insignificant	Low
	2%	7.5%	0.0%	7.5%	Insignificant	Low
	1%	7.7%	4.7%	12.4%	Insignificant	Low
	0.2%	10.1%	35.7%	45.8%	Minor	Low

Coastal Erosion

SLR Scenario	AEP	Proportion of total intangible values at risk	Proportion of total PAR	Potentially Isolated Communities	Total	Consequence Scale	Risk
Current Sea Level	5%	0.0%	0.0%	N/A	0.0%	Insignificant	Low
	2%	0.0%	0.0%		0.0%	Insignificant	Low
	1%	0.0%	0.0%		0.0%	Insignificant	Low
0.2m	5%	5.7%	0.0%	N/A	5.7%	Insignificant	Low
	2%	5.7%	0.0%		5.7%	Insignificant	Low
	1%	6.7%	0.0%		6.7%	Insignificant	Low
0.4m	5%	21.4%	0.0%	N/A	21.4%	Minor	Medium
	2%	21.4%	0.0%		21.4%	Minor	Medium
	1%	27.5%	0.0%		27.5%	Minor	Medium
0.8m	5%	70.4%	0.0%	Isolation	70.4%	Catastrophic	Extreme
	2%	70.4%	0.0%		70.4%	Catastrophic	Extreme
	1%	78.2%	0.0%		78.2%	Catastrophic	Extreme

3.4.10 Buxton

Storm Tide Inundation						
SLR Scenario	**AEP**	**Proportion of total intangible values at risk**	**Proportion of total PAR**	**Total**	**Consequence Scale**	**Risk**
Current Sea Level	**5%**	1.2%	8.5%	9.7%	Insignificant	Low
	2%	1.2%	8.5%	9.7%	Insignificant	Low
	1%	1.2%	8.5%	9.7%	Insignificant	Low
	0.2%	8.8%	66.0%	74.8%	Major	Medium
0.2m	**5%**	2.6%	2.1%	4.7%	Insignificant	Low
	2%	2.6%	2.1%	4.7%	Insignificant	Low
	1%	3.0%	17.0%	20.0%	Minor	Medium
	0.2%	8.2%	61.7%	69.9%	Moderate	Medium
0.4m	**5%**	24.9%	12.8%	37.6%	Minor	Medium
	2%	24.9%	14.9%	39.8%	Minor	Medium
	1%	25.0%	19.1%	44.1%	Minor	Medium
	0.2%	29.1%	46.8%	75.9%	Major	Medium
0.8m	**5%**	54.9%	2.1%	57.0%	Moderate	High
	2%	55.2%	4.3%	59.4%	Moderate	High
	1%	55.2%	6.4%	61.6%	Moderate	Medium
	0.2%	57.0%	23.4%	80.4%	Major	Medium

Coastal Erosion						
SLR Scenario	**AEP**	**Proportion of total intangible values at risk**	**Proportion of total PAR**	**Total**	**Consequence Scale**	**Risk**
0.8m	**5%**	73.3%	0.0%	73.3%	Major	Extreme
	2%	73.3%	0.0%	73.3%	Major	High
	1%	73.3%	0.0%	73.3%	Major	High

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APPENDIX F
RISK ANALYSIS RESULTS

RISK ANALYSIS RESULTS

Results have been summarised in tables for each coastal settlement, including all possible permutations of risk types (Economic, Social, Environmental), hazard types (storm tide inundation and coastal erosion), and sea level conditions (i.e. current sea level, +0.2m, +0.4m and 0.8m increase).

These are shown in the following tables. The risk analysis process identified the coastal settlements that contain areas of high and extreme risk which have been further classified as 'intolerable' risk and may require investigation into mitigation and adaptation options.

F-1 Miara and Norval Park – Risk Analysis Results

Present Day - Storm Tide Inundation	Economic	Social	Environmental	Risk Rating
AEP				
5% (Likely)	Moderate	Minor	Insignificant	High
2% (Possible)	Moderate	Minor	Insignificant	High
1% (Unlikely)	Moderate	Moderate	Minor	Medium
0.2% (Rare)	Moderate	Moderate	Minor	Medium

0.2m SLR - Storm Tide Inundation	Economic	Social	Environmental	Risk Rating
AEP				
5% (Likely)	Moderate	Minor	Insignificant	High
2% (Possible)	Moderate	Minor	Insignificant	High
1% (Unlikely)	Moderate	Moderate	Minor	Medium
0.2% (Rare)	Moderate	Major	Minor	Medium

0.4m SLR - Storm Tide Inundation	Economic	Social	Environmental	Risk Rating
AEP				
5% (Likely)	Moderate	Minor	Minor	High
2% (Possible)	Moderate	Minor	Minor	High
1% (Unlikely)	Moderate	Moderate	Moderate	Medium
0.2% (Rare)	Major	Major	Moderate	Medium

0.8m SLR - Storm Tide Inundation	Economic	Social	Environmental	Risk Rating
AEP				
5% (Likely)	Major	Minor	Minor	Extreme
2% (Possible)	Major	Moderate	Moderate	High
1% (Unlikely)	Major	Major	Major	High
0.2% (Rare)	Major	Major	Major	Medium

0.8m SLR - Erosion Prone Area	Economic	Social	Environmental	Risk Rating
AEP				
5% (Likely)	Major	Major	Minor	Extreme
2% (Possible)	Major	Major	Moderate	High
1% (Unlikely)	Major	Major	Major	High

F-2 Miara and Norval Park – Semi-Permanent Structures Sensitivity Risk Analysis Results

Present Day - Storm Tide Inundation	Economic	Social	Environmental	Risk Rating
AEP				
5% (Likely)	Major	Moderate	Insignificant	Extreme
2% (Possible)	Major	Major	Insignificant	High
1% (Unlikely)	Major	Catastrophic	Minor	Extreme
0.2% (Rare)	Major	Catastrophic	Minor	High

0.2m SLR - Storm Tide Inundation	Economic	Social	Environmental	Risk Rating
AEP				
5% (Likely)	Major	Major	Insignificant	Extreme
2% (Possible)	Major	Major	Insignificant	High
1% (Unlikely)	Major	Catastrophic	Minor	Extreme
0.2% (Rare)	Major	Catastrophic	Minor	High

0.4m SLR - Storm Tide Inundation	Economic	Social	Environmental	Risk Rating
AEP				
5% (Likely)	Major	Major	Minor	Extreme
2% (Possible)	Major	Catastrophic	Minor	Extreme
1% (Unlikely)	Major	Catastrophic	Moderate	Extreme
0.2% (Rare)	Major	Catastrophic	Moderate	High

0.8m SLR - Storm Tide Inundation	Economic	Social	Environmental	Risk Rating
AEP				
5% (Likely)	Major	Catastrophic	Minor	Extreme
2% (Possible)	Major	Catastrophic	Moderate	Extreme
1% (Unlikely)	Catastrophic	Catastrophic	Major	Extreme
0.2% (Rare)	Catastrophic	Catastrophic	Major	High

0.8m SLR - Erosion Prone Area	Economic	Social	Environmental	Risk Rating
AEP				
5% (Likely)	Catastrophic	Major	Minor	Extreme
2% (Possible)	Catastrophic	Major	Moderate	Extreme
1% (Unlikely)	Catastrophic	Major	Major	Extreme

F-3 Moore Park Beach – Risk Analysis Results

Present Day - Storm Tide Inundation	Economic	Social	Environmental	Risk Rating
AEP				
5% (Likely)	Moderate	Insignificant	Insignificant	High
2% (Possible)	Moderate	Insignificant	Insignificant	High
1% (Unlikely)	Moderate	Insignificant	Minor	Medium
0.2% (Rare)	Major	Minor	Minor	Medium

0.2m SLR - Storm Tide Inundation	Economic	Social	Environmental	Risk Rating
AEP				
5% (Likely)	Major	Insignificant	Insignificant	Extreme
2% (Possible)	Major	Insignificant	Insignificant	High
1% (Unlikely)	Major	Insignificant	Minor	High
0.2% (Rare)	Major	Minor	Minor	Medium

0.4m SLR - Storm Tide Inundation	Economic	Social	Environmental	Risk Rating
AEP				
5% (Likely)	Major	Insignificant	Minor	Extreme
2% (Possible)	Major	Insignificant	Minor	High
1% (Unlikely)	Major	Insignificant	Moderate	High
0.2% (Rare)	Major	Moderate	Moderate	Medium

0.8m SLR - Storm Tide Inundation	Economic	Social	Environmental	Risk Rating
AEP				
5% (Likely)	Major	Insignificant	Minor	Extreme
2% (Possible)	Major	Insignificant	Moderate	High
1% (Unlikely)	Major	Minor	Major	High
0.2% (Rare)	Catastrophic	Catastrophic	Major	High

Present Day - Erosion Prone Area	Economic	Social	Environmental	Risk Rating
AEP				
5% (Likely)	Moderate	Insignificant	Insignificant	High
2% (Possible)	Moderate	Insignificant	Insignificant	High
1% (Unlikely)	Moderate	Insignificant	Minor	Medium

0.2m SLR - Erosion Prone Area	Economic	Social	Environmental	Risk Rating
AEP				
5% (Likely)	Major	Insignificant	Insignificant	Extreme
2% (Possible)	Major	Insignificant	Insignificant	High
1% (Unlikely)	Major	Insignificant	Minor	High

0.4m SLR - Erosion Prone Area	Economic	Social	Environmental	Risk Rating
AEP				
5% (Likely)	Major	Major	Minor	Extreme
2% (Possible)	Catastrophic	Major	Minor	Extreme
1% (Unlikely)	Catastrophic	Major	Moderate	Extreme

0.8m SLR - Erosion Prone Area	Economic	Social	Environmental	Risk Rating
AEP				
5% (Likely)	Catastrophic	Catastrophic	Minor	Extreme
2% (Possible)	Catastrophic	Catastrophic	Moderate	Extreme
1% (Unlikely)	Catastrophic	Catastrophic	Major	Extreme

F-4 Burnett Heads – Risk Analysis Results

Present Day - Storm Tide Inundation	Economic	Social	Environmental	Risk Rating
AEP				
5% (Likely)	Major	Insignificant	Insignificant	Extreme
2% (Possible)	Major	Insignificant	Insignificant	High
1% (Unlikely)	Major	Minor	Insignificant	High
0.2% (Rare)	Major	Moderate	Insignificant	Medium

0.2m SLR - Storm Tide Inundation	Economic	Social	Environmental	Risk Rating
AEP				
5% (Likely)	Major	Insignificant	Insignificant	Extreme
2% (Possible)	Major	Insignificant	Insignificant	High
1% (Unlikely)	Major	Minor	Insignificant	High
0.2% (Rare)	Major	Moderate	Insignificant	Medium

0.4m SLR - Storm Tide Inundation	Economic	Social	Environmental	Risk Rating
AEP				
5% (Likely)	Major	Insignificant	Insignificant	Extreme
2% (Possible)	Major	Insignificant	Insignificant	High
1% (Unlikely)	Major	Minor	Minor	High
0.2% (Rare)	Major	Major	Minor	Medium

0.8m SLR - Storm Tide Inundation	Economic	Social	Environmental	Risk Rating
AEP				
5% (Likely)	Catastrophic	Minor	Insignificant	Extreme
2% (Possible)	Catastrophic	Minor	Insignificant	Extreme
1% (Unlikely)	Catastrophic	Moderate	Minor	Extreme
0.2% (Rare)	Catastrophic	Catastrophic	Minor	High

0.8m SLR - Erosion Prone Area	Economic	Social	Environmental	Risk Rating
AEP				
5% (Likely)	Catastrophic	Minor	Insignificant	Extreme
2% (Possible)	Catastrophic	Minor	Insignificant	Extreme
1% (Unlikely)	Catastrophic	Minor	Minor	Extreme

F-5 Bargara – Risk Analysis Results

Present Day - Storm Tide Inundation	Economic	Social	Environmental	Risk Rating
AEP				
5% (Likely)	Insignificant	Insignificant	Insignificant	Low
2% (Possible)	Insignificant	Insignificant	Insignificant	Low
1% (Unlikely)	Minor	Insignificant	Insignificant	Medium
0.2% (Rare)	Minor	Insignificant	Insignificant	Low

0.2m SLR - Storm Tide Inundation	Economic	Social	Environmental	Risk Rating
AEP				
5% (Likely)	Insignificant	Insignificant	Insignificant	Low
2% (Possible)	Insignificant	Insignificant	Insignificant	Low
1% (Unlikely)	Minor	Insignificant	Insignificant	Medium
0.2% (Rare)	Minor	Insignificant	Minor	Low

0.4m SLR - Storm Tide Inundation	Economic	Social	Environmental	Risk Rating
AEP				
5% (Likely)	Insignificant	Insignificant	Insignificant	Low
2% (Possible)	Insignificant	Insignificant	Insignificant	Low
1% (Unlikely)	Insignificant	Insignificant	Minor	Medium
0.2% (Rare)	Moderate	Moderate	Minor	Medium

0.8m SLR - Storm Tide Inundation	Economic	Social	Environmental	Risk Rating
AEP				
5% (Likely)	Major	Insignificant	Insignificant	Extreme
2% (Possible)	Major	Insignificant	Insignificant	High
1% (Unlikely)	Major	Insignificant	Minor	High
0.2% (Rare)	Major	Moderate	Moderate	Medium

0.8m SLR - Erosion Prone Area	Economic	Social	Environmental	Risk Rating
AEP				
5% (Likely)	Catastrophic	Moderate	Insignificant	Extreme
2% (Possible)	Catastrophic	Moderate	Insignificant	Extreme
1% (Unlikely)	Catastrophic	Moderate	Minor	Extreme

F-6 Kellys Beach (Bargara) – Risk Analysis Results

Present Day - Erosion Prone Area	Economic	Social	Environmental	Risk Rating
AEP				
5% (Likely)	Major	Minor	Insignificant	Extreme
2% (Possible)	Major	Minor	Insignificant	High
1% (Unlikely)	Major	Minor	Insignificant	High

0.2m SLR - Erosion Prone Area	Economic	Social	Environmental	Risk Rating
AEP				
5% (Likely)	Major	Moderate	Insignificant	Extreme
2% (Possible)	Major	Moderate	Insignificant	High
1% (Unlikely)	Major	Moderate	Insignificant	High

0.4m SLR - Erosion Prone Area	Economic	Social	Environmental	Risk Rating
AEP				
5% (Likely)	Major	Moderate	Insignificant	Extreme
2% (Possible)	Major	Moderate	Insignificant	High
1% (Unlikely)	Major	Moderate	Minor	High

0.8m SLR - Erosion Prone Area	Economic	Social	Environmental	Risk Rating
AEP				
5% (Likely)	Major	Major	Insignificant	Extreme
2% (Possible)	Major	Major	Insignificant	High
1% (Unlikely)	Major	Major	Minor	High

F-7 Innes Park and Coral Cove – Risk Analysis Results

Present Day - Storm Tide Inundation	Economic	Social	Environmental	Risk Rating
AEP				
5% (Likely)	Insignificant	Insignificant	Insignificant	Low
2% (Possible)	Insignificant	Insignificant	Insignificant	Low
1% (Unlikely)	Insignificant	Insignificant	Minor	Medium
0.2% (Rare)	Minor	Minor	Minor	Low

0.2m SLR - Storm Tide Inundation	Economic	Social	Environmental	Risk Rating
AEP				
5% (Likely)	Insignificant	Insignificant	Insignificant	Low
2% (Possible)	Insignificant	Insignificant	Insignificant	Low
1% (Unlikely)	Insignificant	Minor	Minor	Medium
0.2% (Rare)	Minor	Minor	Minor	Low

0.4m SLR - Storm Tide Inundation	Economic	Social	Environmental	Risk Rating
AEP				
5% (Likely)	Moderate	Insignificant	Insignificant	High
2% (Possible)	Moderate	Minor	Minor	High
1% (Unlikely)	Moderate	Minor	Minor	Medium
0.2% (Rare)	Moderate	Minor	Moderate	Medium

0.8m SLR - Storm Tide Inundation	Economic	Social	Environmental	Risk Rating
AEP				
5% (Likely)	Moderate	Minor	Minor	High
2% (Possible)	Moderate	Minor	Minor	High
1% (Unlikely)	Moderate	Minor	Moderate	Medium
0.2% (Rare)	Moderate	Minor	Major	Medium

Present Day - Erosion Prone Area	Economic	Social	Environmental	Risk Rating
AEP				
5% (Likely)	Insignificant	Insignificant	Insignificant	Low
2% (Possible)	Insignificant	Insignificant	Insignificant	Low
1% (Unlikely)	Insignificant	Insignificant	Minor	Medium

0.2m SLR - Erosion Prone Area	Economic	Social	Environmental	Risk Rating
AEP				
5% (Likely)	Insignificant	Insignificant	Insignificant	Low
2% (Possible)	Insignificant	Insignificant	Insignificant	Low
1% (Unlikely)	Insignificant	Insignificant	Minor	Medium

0.4m SLR - Erosion Prone Area	Economic	Social	Environmental	Risk Rating
AEP				
5% (Likely)	Moderate	Minor	Insignificant	High
2% (Possible)	Moderate	Minor	Minor	High
1% (Unlikely)	Moderate	Minor	Minor	Medium

0.8m SLR - Erosion Prone Area	Economic	Social	Environmental	Risk Rating
AEP				
5% (Likely)	Major	Catastrophic	Minor	Extreme
2% (Possible)	Major	Catastrophic	Minor	Extreme
1% (Unlikely)	Major	Catastrophic	Moderate	Extreme

F-8 Elliott Heads – Risk Analysis Results

Present Day - Storm Tide Inundation	Economic	Social	Environmental	Risk Rating
AEP				
5% (Likely)	Minor	Insignificant	Insignificant	Medium
2% (Possible)	Minor	Insignificant	Insignificant	Medium
1% (Unlikely)	Minor	Insignificant	Minor	Medium
0.2% (Rare)	Moderate	Insignificant	Minor	Medium

0.2m SLR - Storm Tide Inundation	**Economic**	**Social**	**Environmental**	**Risk Rating**
AEP				
5% (Likely)	Minor	Insignificant	Insignificant	Medium
2% (Possible)	Minor	Insignificant	Insignificant	Medium
1% (Unlikely)	Minor	Insignificant	Minor	Medium
0.2% (Rare)	Moderate	Insignificant	Minor	Medium

0.4m SLR - Storm Tide Inundation	**Economic**	**Social**	**Environmental**	**Risk Rating**
AEP				
5% (Likely)	Minor	Insignificant	Minor	Medium
2% (Possible)	Minor	Insignificant	Minor	Medium
1% (Unlikely)	Moderate	Insignificant	Moderate	Medium
0.2% (Rare)	Moderate	Insignificant	Moderate	Medium

0.8m SLR - Storm Tide Inundation	**Economic**	**Social**	**Environmental**	**Risk Rating**
AEP				
5% (Likely)	Moderate	Insignificant	Minor	High
2% (Possible)	Moderate	Insignificant	Moderate	High
1% (Unlikely)	Moderate	Insignificant	Major	High
0.2% (Rare)	Moderate	Moderate	Major	Medium

0.8m SLR - Erosion Prone Area	**Economic**	**Social**	**Environmental**	**Risk Rating**
AEP				
5% (Likely)	Major	Moderate	Minor	Extreme
2% (Possible)	Major	Moderate	Moderate	High
1% (Unlikely)	Major	Moderate	Major	High

F-9 Coonarr – Risk Analysis Results

Present Day - Storm Tide Inundation	Economic	Social	Environmental	Risk Rating
AEP				
5% (Likely)	Insignificant	Insignificant	Insignificant	Low
2% (Possible)	Insignificant	Insignificant	Insignificant	Low
1% (Unlikely)	Insignificant	Insignificant	Insignificant	Low
0.2% (Rare)	Insignificant	Insignificant	Minor	Low

0.2m SLR - Storm Tide Inundation	Economic	Social	Environmental	Risk Rating
AEP				
5% (Likely)	Insignificant	Insignificant	Insignificant	Low
2% (Possible)	Insignificant	Insignificant	Insignificant	Low
1% (Unlikely)	Insignificant	Insignificant	Minor	Medium
0.2% (Rare)	Insignificant	Insignificant	Minor	Low

0.4m SLR - Storm Tide Inundation	Economic	Social	Environmental	Risk Rating
AEP				
5% (Likely)	Insignificant	Insignificant	Insignificant	Low
2% (Possible)	Insignificant	Insignificant	Minor	Medium
1% (Unlikely)	Insignificant	Insignificant	Minor	Medium
0.2% (Rare)	Insignificant	Insignificant	Moderate	Medium

0.8m SLR - Storm Tide Inundation	Economic	Social	Environmental	Risk Rating
AEP				
5% (Likely)	Minor	Insignificant	Minor	Medium
2% (Possible)	Minor	Insignificant	Minor	Medium
1% (Unlikely)	Minor	Insignificant	Moderate	Medium
0.2% (Rare)	Minor	Insignificant	Major	Medium

Present Day - Erosion Prone Area	Economic	Social	Environmental	Risk Rating
AEP				
5% (Likely)	Insignificant	Insignificant	Insignificant	Low
2% (Possible)	Insignificant	Insignificant	Insignificant	Low
1% (Unlikely)	Insignificant	Insignificant	Insignificant	Low

0.2m SLR - Erosion Prone Area	Economic	Social	Environmental	Risk Rating
AEP				
5% (Likely)	Insignificant	Catastrophic	Insignificant	Extreme
2% (Possible)	Insignificant	Catastrophic	Insignificant	Extreme
1% (Unlikely)	Moderate	Catastrophic	Minor	Extreme

0.4m SLR - Erosion Prone Area	Economic	Social	Environmental	Risk Rating
AEP				
5% (Likely)	Moderate	Catastrophic	Insignificant	Extreme
2% (Possible)	Moderate	Catastrophic	Minor	Extreme
1% (Unlikely)	Moderate	Catastrophic	Minor	Extreme

0.8m SLR - Erosion Prone Area	Economic	Social	Environmental	Risk Rating
AEP				
5% (Likely)	Moderate	Catastrophic	Minor	Extreme
2% (Possible)	Moderate	Catastrophic	Minor	Extreme
1% (Unlikely)	Moderate	Catastrophic	Moderate	Extreme

F-10 Woodgate Beach and Walkers Point – Risk Analysis Results

Present Day - Storm Tide Inundation	Economic	Social	Environmental	Risk Rating
AEP				
5% (Likely)	Minor	Insignificant	Insignificant	Medium
2% (Possible)	Minor	Insignificant	Minor	Medium
1% (Unlikely)	Minor	Insignificant	Minor	Medium
0.2% (Rare)	Moderate	Insignificant	Minor	Medium

0.2m SLR - Storm Tide Inundation	Economic	Social	Environmental	Risk Rating
AEP				
5% (Likely)	Minor	Insignificant	Insignificant	Medium
2% (Possible)	Minor	Insignificant	Minor	Medium
1% (Unlikely)	Minor	Insignificant	Minor	Medium
0.2% (Rare)	Moderate	Insignificant	Moderate	Medium

0.4m SLR - Storm Tide Inundation	Economic	Social	Environmental	Risk Rating
AEP				
5% (Likely)	Moderate	Insignificant	Minor	High
2% (Possible)	Moderate	Insignificant	Moderate	High
1% (Unlikely)	Moderate	Insignificant	Moderate	Medium
0.2% (Rare)	Moderate	Insignificant	Major	Medium

0.8m SLR - Storm Tide Inundation	Economic	Social	Environmental	Risk Rating
AEP				
5% (Likely)	Major	Insignificant	Moderate	Extreme
2% (Possible)	Major	Insignificant	Major	High
1% (Unlikely)	Major	Insignificant	Catastrophic	Extreme
0.2% (Rare)	Major	Minor	Catastrophic	High

Present Day - Erosion Prone Area	Economic	Social	Environmental	Risk Rating
AEP				
5% (Likely)	Insignificant	Insignificant	Insignificant	Low
2% (Possible)	Insignificant	Insignificant	Minor	Medium
1% (Unlikely)	Insignificant	Insignificant	Minor	Medium

0.2m SLR - Erosion Prone Area	Economic	Social	Environmental	Risk Rating
AEP				
5% (Likely)	Major	Insignificant	Insignificant	Extreme
2% (Possible)	Major	Insignificant	Minor	High
1% (Unlikely)	Major	Insignificant	Minor	High

0.4m SLR - Erosion Prone Area	Economic	Social	Environmental	Risk Rating
AEP				
5% (Likely)	Major	Minor	Minor	Extreme
2% (Possible)	Major	Minor	Moderate	High
1% (Unlikely)	Catastrophic	Minor	Moderate	Extreme

0.8m SLR - Erosion Prone Area	Economic	Social	Environmental	Risk Rating
AEP				
5% (Likely)	Catastrophic	Catastrophic	Moderate	Extreme
2% (Possible)	Catastrophic	Catastrophic	Major	Extreme
1% (Unlikely)	Catastrophic	Catastrophic	Catastrophic	Extreme

I-11 Buxton – Risk Analysis Results

Present Day - Storm Tide Inundation	Economic	Social	Environmental	Risk Rating
AEP				
5% (Likely)	Minor	Insignificant	Insignificant	Medium
2% (Possible)	Minor	Insignificant	Insignificant	Medium
1% (Unlikely)	Minor	Insignificant	Insignificant	Medium
0.2% (Rare)	Moderate	Major	Insignificant	Medium

0.2m SLR - Storm Tide Inundation	Economic	Social	Environmental	Risk Rating
AEP				
5% (Likely)	Moderate	Insignificant	Insignificant	High
2% (Possible)	Moderate	Insignificant	Insignificant	High
1% (Unlikely)	Moderate	Minor	Minor	Medium
0.2% (Rare)	Moderate	Moderate	Minor	Medium

0.4m SLR - Storm Tide Inundation	Economic	Social	Environmental	Risk Rating
AEP				
5% (Likely)	Major	Minor	Insignificant	Extreme
2% (Possible)	Major	Minor	Minor	High
1% (Unlikely)	Major	Minor	Minor	High
0.2% (Rare)	Major	Major	Minor	Medium

0.8m SLR - Storm Tide Inundation	Economic	Social	Environmental	Risk Rating
AEP				
5% (Likely)	Major	Moderate	Minor	Extreme
2% (Possible)	Major	Moderate	Minor	High
1% (Unlikely)	Major	Moderate	Moderate	High
0.2% (Rare)	Major	Major	Moderate	Medium

0.8m SLR - Erosion Prone Area	**Economic**	**Social**	**Environmental**	**Risk Rating**
AEP				
5% (Likely)	Major	Major	Minor	Extreme
2% (Possible)	Major	Major	Minor	High
1% (Unlikely)	Major	Major	Moderate	High

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