Fraser Coast Coastal Hazard Adaptation Strategy (CHAS)

Coastal Futures: Planning Our Changing Coastline

Phase 4 – Assets at Risk

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Synopsis: **This report presents the assessment of assets exposed to current and future coastal hazards within the Fraser Coast Regional Council area.**

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Executive Summary

An assessment of the natural and built assets impacted by coastal hazards was undertaken for Phase 4 of the Fraser Coast Coastal Hazard Adaptation Strategy – *Coastal Futures: Planning Our Changing Coastline.*

The assessment considered storm tide, sea level rise and erosion hazard extents and inundation depths determined in Phase 3 of the CHAS for the present climate and 2050 and 2100 future climates to support identification of key assets to be considered in a risk assessment.

In general, the mainland Hervey Bay frontage of the local government area has wide inter-tidal beaches backed by low dunes, beach ridge plains and extensive wetland areas. Urban development on these plains are exposed to erosion and inundation hazards under the present and future climates, particularly at Burrum Heads, Toogoom, Dundowran, Pialba, Scarness, Torquay and Urangan.

South of this area the coastline becomes more estuarine and has markedly reduced erosion exposure and intensity of community usage. K'gari (Fraser Island), an international tourist destination, has a mixture of shorelines, with large parabolic dunes fronted by sandy surf beaches on the eastern shoreline. The beaches become flatter on the northern shoreline, and estuarine on the western shoreline. Development on K'gari is limited to small areas around the island.

The assessment identified that large areas of high natural and social/cultural value are impacted under present and future climate scenarios for erosion and inundation hazards. This includes extensive mainland and World Heritage listed K'gari beach and dune areas along the open coast and Hervey Bay shoreline.

Beaches are expected to be unavailable immediately following major storm erosion where beach lowering or significant slumping of the dunes has occurred, and during periods of elevated water levels (e.g. storm tide events or higher tides). This has additional relevance for K'gari, where the beach is also used for vehicular access.

Areas where the dune is unable to function naturally under the present climate in response to coastal erosion, either due to the presence of existing coastal protection structures such as seawalls or proximity of built development include parts of Burrum Heads, Toogoom, Torquay, and Urangan. Elsewhere, the dune can accommodate some erosion but may be completely impacted by erosion under future climates.

Extensive estuarine wetland areas of national and/or state significance are within all hazard extents, particularly in Great Sandy Strait (Ramsar listed wetlands and declared Fish Habitat Area) and around the numerous creek and river systems throughout the Shire, particularly Mary, Susan and Burrum Rivers and Eli, O'Regan, and Beelbi Creeks and their tributaries.

Residential, resort and commercial areas throughout the local government area are within hazard extents. This includes existing urbanised areas exposed to present climate coastal hazards at Burrum Heads, Toogoom to Urangan, and River Heads. Assets impacted include private properties, roads, water supply, sewerage and stormwater infrastructure. Assets closest to waterways and the coastline are impacted earliest, with some local roads within sea level rise extents by 2050.

Inundation hazards and the influence of sea level rise on erosion hazard extents are notable in these areas, with development affected as a result of dune overtopping as well as via creek networks. Important community assets such as Wetside, piers, boating infrastructure, reserves, beachfront and riverfront caravan parks, and

heritage assets or sites of significance throughout the area are exposed to all coastal hazards under the present and future climates.

High and medium density residential areas are impacted by sea level rise in Scarness by 2050, and Urangan by 2100. All localities from Eli Creek to Urangan within the high density residential zone are within storm tide and erosion hazard extents for all climates, while medium density residential areas are mainly exposed to storm tide impacts. Schools and aged care facilities are located within the storm tide hazard extents. Impacts progressively extend inland as inundation levels increase, particularly via Tooan Tooan Creek and the associated lagoons.

The large Mixed Use zone around Urangan Boat Harbour is heavily impacted by all hazards under all climates, largely because the on-water area is included in the zoning. By 2100 sea level rise starts to impact on the adjacent car parking areas.

The Great Sandy Strait community of Boonooroo is heavily impacted by sea level rise by 2050, while the seaward fringes of all Great Sandy Strait communities are within all hazard extents under all climates. Tinnanbar is the least affected of the villages due to its higher elevation and retention of a public reserve along the foreshore.

Residential and resort development at Kingfisher Bay and on Stewart Island in Great Sandy Strait are within storm tide and erosion hazard extents under present and future climate scenarios, with development at Eurong within erosion hazard extents.

As the Mary River has a long history of catchment flooding, most development along its banks is elevated and set back from the river. In places where the river channel is very well defined, inundation impacts from sea level rise and storm tide are largely confined within the existing river channel. Most impacts in this area are limited to the fringes of riverfront properties, affecting marine infrastructure such as marinas and boat houses, as well as a number of heritage assets.

Areas zoned as emerging communities (i.e. future residential areas) are within all hazard extents over all climates at Burrum Heads near Beelbi Creek and at Dundowran/Dundowran Beach near Eli Creek. A small area of land at River Heads near the Susan River is affected by all hazards other than present climate highest astronomical tide.

Important roads located within hazard extents include Pialba Burrum Heads Road, which is affected by a variety of hazards and climates at the crossing of Beelbi, O'Regan and Eli Creeks. Booral Road, where it crosses Stockyard and Bunya Creeks, and Maryborough Hervey Bay Road at the Susan River crossing are impacted by erosion hazards under all climates and storm tide hazards. These roads are also evacuation routes.

The evacuation route at Boonooroo is impacted by the 2100 climate in the vicinity of Little Tuan Creek.

Road and rail crossings of the Mary River and Burrum River in and around Maryborough and Howard respectively are all within erosion hazard extents. This includes the Bruce Highway, Ferry Street, Odessa Street and Burgowan Road.

Local roads servicing urban development, especially those close to creeks and waterways, are within all hazard extents for all climates except for present climate HAT. This includes the Esplanade at Pialba/Point Vernon, which has more than 250m affected by sea level rise under the 2050 climate, and substantial lengths of roads around Boonooroo.

Rural land impacts throughout the local government area mainly affect land used for grazing or conservation purposes, with land affected under all hazards and all climates. Around the mouth of the Susan and Mary Rivers impacted rural land is mostly saline marsh or wetlands of state environmental significance, some of which is Ramsar listed.

Access to K'gari is affected, with barge access points on K'gari and at River Heads within all hazard extents, under all climates. All recreational boating facilities are impacted.

Important public health infrastructure impacted includes:

- Burrum Heads sewage treatment plant, which is impacted by storm tide by the 2100 climate, although fringes of the site are impacted by 2050 and by other hazards
- Toogoom landfill, which is affected by storm tide by 2050
- The weir and pump station on the Burrum River that are within the 2100 storm tide and erosion hazard extents
- The Eli Creek sewage treatment plant site, which is impacted by the 2100 storm tide hazard extent
- Pulgul waste water treatment plant site, which is exposed under all climates to a variety of hazards, however site infrastructure may not be affected
- Tidal barrages and weirs on the Mary River, with Weir No 1 breached by the 2100 climate storm tide
- Teddington water treatment plant, where the site but not infrastructure is within the 2100 climate storm tide extent
- Aubinville waste treatment plant site, which is within all hazard extents for all climates, however the plant itself is impacted by the 2100 storm tide extent.

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1 Introduction

1.1 Purpose of the Report

Fraser Coast Regional Council (FCRC) has commenced studies to support preparation of a Coastal Hazard Adaptation Strategy (CHAS) under the QCoast$_{2100}$ program, known locally as the *Coastal Futures: Planning Our Changing Coastline* project. Phase 2 of the CHAS identified potential risks to the community, assets and values associated with coastal hazards, specifically:

- Temporary flooding of coastal areas due to storm tide;
- Temporary loss of land due to coastal erosion; and
- Permanent loss of land due to coastal erosion and sea level rise.

This report has been prepared to understand the potential impacts and support an assessment of risks from these hazards. Specifically, this assessment identifies the key assets exposed to coastal hazards for the current to short-term climate (2019 to 2030, referred to throughout this report as present climate), and medium to long-term (nominally 2050 and 2100) projected future climates. The nature and magnitude of the hazards has been established in FCRC's CHAS Phase 3 studies.

1.2 QCoast$_{2100}$ Program

The QCoast$_{2100}$ program has been designed to assist Queensland coastal councils with funding and technical support to progress the preparation of plans and strategies to address climate change related coastal hazard risks. Governed by a Board comprising members from the Local Government Associated of Queensland (LGAQ), Department of Environment and Science (DES) and Department of Local Government, Racing and Multicultural Affairs (DLGRMA), the program is intended to guide decision-making across key areas of local government planning and operations, including:

- Corporate and operational planning and financial planning;
- Land use planning and development assessment;
- Infrastructure planning and management including roads, stormwater and foreshores;
- Asset management and planning including nature conservation, recreation, cultural heritage values and other public amenities;
- Community planning; and
- Emergency management.

The QCoast$_{2100}$ Minimum Standards & Guidelines (MS&G) (DEHP, 2016) provide guidance to local government on preparing a CHAS. The guidelines set minimum requirements that are to be included in a CHAS, as well as providing information on leading practices to facilitate continuous improvement.

The minimum standards set a benchmark for undertaking such studies in Queensland so that coastal hazard adaptation decision-making is approached in a consistent and systematic manner. The MS&G are structured to address the key phases of a CHAS which are illustrated in Figure 1-1. This report is a key output of Phase 4 – the identification of assets exposed to current and future coastal hazards.

This report provides critical inputs that will be used to inform the risk assessment process.

Figure 1-1 QCoast$_{2100}$ Phases (DEHP, 2016)

1.2.1 Phase 2 Scoping Study

The Phase 2 Scoping Study report summarises the data and information needed to undertake a coastal hazard risk assessment in accordance with AS/NZS ISO 31000:2009. Tailoring of coastal hazard mapping, including an updated assessment of storm tide, identification of intangible assets and valuations of assets were identified as priority tasks to be completed to inform the risk assessment.

The assessment identified at a high level those assets exposed to coastal hazards based on data provided by FCRC. The scoping study also identified the suitability of the previous hazard assessments, and any additional assessment to be undertaken in Phase 3.

1.2.2 Phase 3 Hazard Assessment

1.2.2.1 Erosion Hazard

A recalculation of the State's erosion prone area widths (which are nominally for the year 2100) was completed by Cardno (2012) for the Hervey Bay coastline between River Heads and Burrum Heads, and around the five Great Sandy Strait settlements (Tinnanbar, Poona, Tuan, Boonooroo and Maaroom). The approach used by Cardno for the Hervey Bay coastline involved the interpolation of the State's open coast calculated 2100 erosion prone area (EPA) widths with the contributions for long-term erosion and sea level rise in the declared 2100 EPA widths reduced to reflect the shortened time periods.

Cardno's mapping for the Great Sandy Strait was identified as being inconsistent with the State's EPA definition. Phase 3 reporting discusses the updates that were made to mapping in those areas, as well as the mapping prepared for estuarine areas elsewhere within the local government area.

The Cardno assessment of erosion hazard areas was undertaken to inform the development of a shoreline erosion management plan for the region. No reduction in erosion prone area widths was applied to locations with coastal protection structures such as seawalls, which aligns with the approach used in the State's 2100 EPA mapping. As the protection offered by these structures relies on their condition and design suitability, their presence is considered during the risk assessment process.

To support the assessment of assets in other open coast areas not covered by the Cardno (2012) assessment (i.e. K'gari (Fraser Island)), BMT applied the same methodology used by Cardno to complete the understanding of the open coast erosion hazard. For the present climate and the 2050 future climate, the contributions for long-term erosion and sea level rise in the declared 2100 EPA widths were reduced to reflect the shortened time periods.

In accordance with the definition of the erosion prone area (DEHP, 2013), the erosion prone area along the coast is the greater of:

(1) The calculated open coast erosion area;

(2) The nominated buffer distance inland of the line of highest astronomical tide (HAT) (wave action/tidal flow erosion buffer); and

(3) The plan position of projected sea level rise above the elevation of HAT (sea level rise erosion).

In estuarine areas, such as elsewhere in Great Sandy Strait and within the Mary and Burrum River catchments, the erosion prone area was determined as being the greater of:

(1) The nominated buffer distance inland of the line of highest astronomical tide (HAT) (wave action/tidal flow erosion buffer); and

(2) The plan position of projected sea level rise above the elevation of HAT (sea level rise erosion).

For the FCRC assessment, the allowances adopted for the buffer distance and sea level rise for present and future climates are set out in Table 1-1. Since the present climate covers the period from 2019 to 2030, an allowance for sea level rise has been included.

Table 1-1 Estuarine Erosion Prone Area Allowances

Allowance	Present Climate (2019 – 2030)	2050 Future Climate	2100 Future Climate
Buffer (m)	10	20	40
Sea level rise (m)	0.1	0.3	0.8

1.2.2.2 Storm Tide

A storm tide hazard assessment and associated mapping was prepared as part of Phase 3 work for the entire local government area, including Fraser Island (BMT, 2019).

The assessment provides statistics up to the 1,000 year Average Recurrence Interval (or 0.1% Average Exceedance Probability) across the local government area and considers extreme water levels associated with tropical cyclone and non-tropical cyclone weather systems.

Storm tide levels were assessed for the present climate and 2050 and 2100 future climates. The 1 in 100 year (1% AEP) storm tide event for each of these climates is used in this asset assessment. Mapping of hazard extents was developed using the storm tide elevations from the study and applied to the 2009 and 2015 LiDAR elevation data.

The modelling and mapping used in the asset assessment made the following key assumptions:

- The potential influence of wave processes is considered within a 200 m buffer landward of the coastline.
- Across the coastal floodplain beyond the 200 m landward buffer, the influence of waves is assumed to reduce.
- Tide plus surge' peak water levels have been applied throughout the Great Sandy Strait and within the Mary and Burrum Rivers.
- Freeboard has not been applied as different freeboard allowances may apply to different areas depending on usage of the land and the relative exposure to coastal processes.

Additional details on the storm tide assessment and mapping can be found in the associated Phase 3 reports.

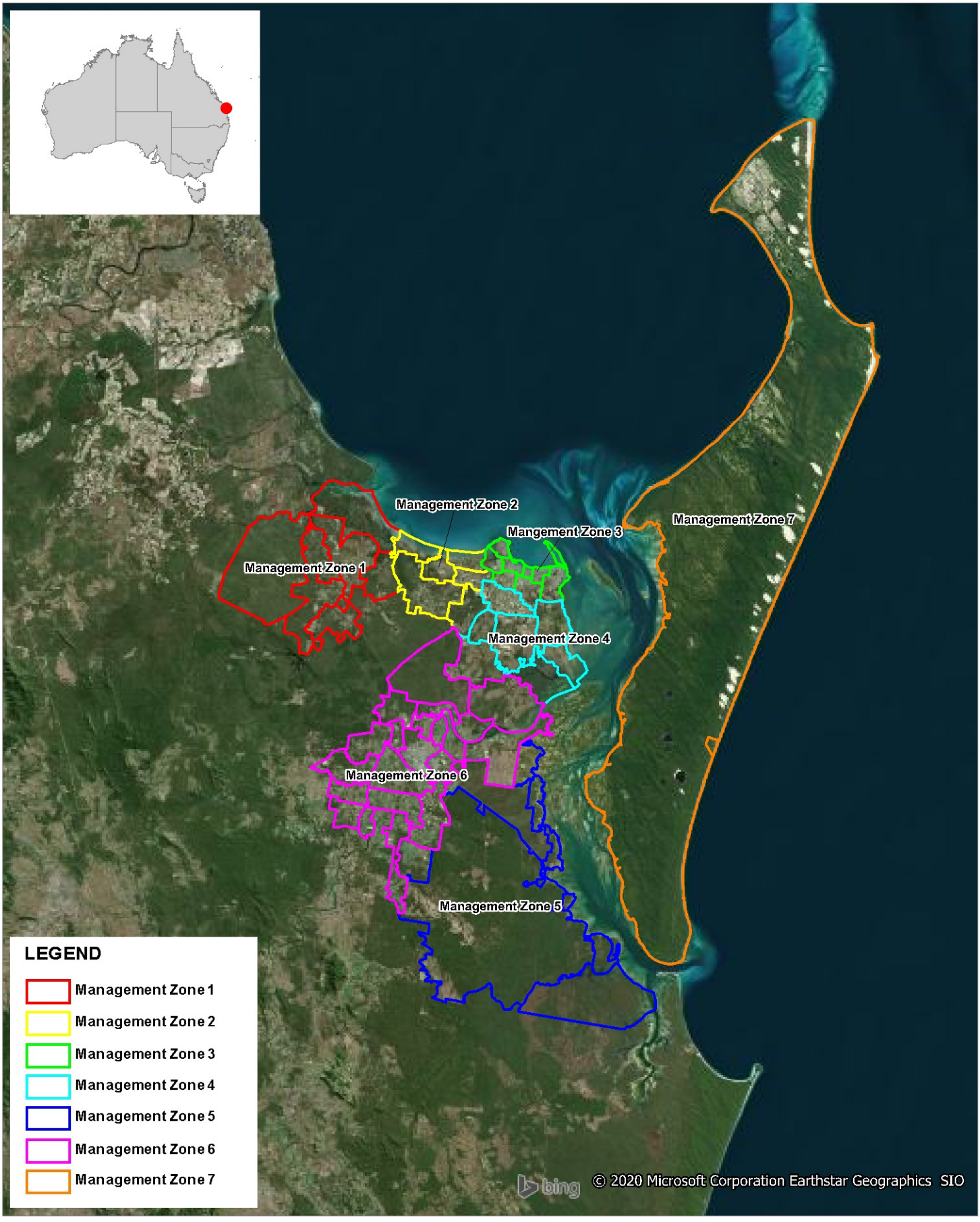
1.2.2.3 Sea Level Rise

Sea-level rise hazard mapping has been developed for the present climate and 2050 and 2100 future climates using the 2009 and 2015 LiDAR elevation data, based on increases relative to present climate HAT values along the coast developed in the storm tide study. Sea level rise allowances are in accordance with those set out in Table 1-1.

1.3 Report Structure

Development in the FCRC coastal zone tends to consist of a mixture of an urbanised area extending from Urangan to Point Vernon, and discrete settlements or rural residential elsewhere. Following on from the CHAS Phase 2 report, the study area has been divided into seven management zones based on adjacent and similar localities for the assessment, as shown in Figure 1-2. From north on the mainland, these areas and the localities within them are:

- Management Zone 1 – Burrum Heads, Burrum River, Beelbi Creek, Burrum Town, Torbanlea, Howard, Cherwell and Pacific Haven.
- Management Zone 2 – Toogoom, Craignish, Dundowran Beach, Dundowran, Takura and Walligan.
- Management Zone 3 – Urraween, Pialba, Scarness, Torquay, Urangan, Eli Waters, Point Vernon.
- Management Zone 4 – Booral, Bunya Creek, Nikenbah, River Heads, Sunshine Acres, Susan River.



Title:

Fraser Coast CHAS Management Zones

Figure: 1-2

Rev: A

BMT WBM endeavours to ensure that the information provided in this map is correct at the time of publication. BMT WBM does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

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- Management Zone 5 – Boonooroo, Boonooroo Plains, Maaroom, Poona, The Dimonds, Tin Can Bay, Tinnanbar, Tuan, Tuan Forest.
- Management Zone 6 – Aldershot, Antigua, Beaver Rock, Bidwill, Dundathu, Ferney, Glenorchy, Grahams Creek, Granville, Island Plantation, Maryborough, Maryborough West, Mungar, Oakhurst, Owanyilla, Pioneer's Rest, Prawle, St Helens, Tandora, Teddington, Tinana, Tinana South, Walkers Point, Walliebum, Yengarie.
- Management Zone 7 – Fraser Island, Eurong, Great Sandy Strait (covers the islands and waterway).

1.3.1 Asset Assessment Approach

Asset data in the following Geographic Information System (GIS) formats was assessed:

- "point" data – e.g. a small asset such as a valve or a pump station, or the $ value of an asset
- "polygon" data – e.g. land parcels or major assets of interest
- "polyline" data – e.g. network assets such as roads, sewerage, water supply etc, often recorded in segments.

A summary of the digital datasets in GIS format available to this assessment is provided in Appendix A, Table A-1.

Assets at risk from erosion hazards were identified by intersecting each asset layer with the erosion hazard extent developed in Phase 3 for each climate scenario. As inundation hazards have been mapped as depth grids, the inundation depth can vary substantially across polygon and polyline assets. By intersecting assets against inundation hazards grids, the maximum inundation depth recorded for that asset segment was extracted to inform the consequence of inundation impacts in Phase 5.

Note that some network assets such as water and sewerage can be buried. For the purposes of the CHAS, all assets within plan extents of erosion and inundation hazards have been identified.

Some data was available in point format as well as polygon or polyline format (e.g. asset value data in point format for council land (polygon)). It is important to note that some land parcels or network assets such as roads or pipelines may be partially within the hazard extent, but the associated point data (such as $ values) may not be. For the purposes of the CHAS, the approach adopted in this assessment is considered suitable based on the regional nature of the assessment, timescales of climate scenarios considered, and the uncertainty in the hazard mapping and modelling. Future iterations of the CHAS or asset specific assessments may choose to further refine the assessment of point layer data for specific assets considered to be critical.

The analysis for each management zone is summarised in an overview table for a quick identification of the types of assets impacted, followed by a more detailed table that indicates the extents of asset impacts.

In addition, a summary of all asset types affected within the FCRC area is provided in Table 1-2.

Table 1-2 Summary of Assets Impacted by Coastal Hazards

Planning Zones / Asset Class	Present Climate (2019-2030)			2050 Future Climate			2100 Future Climate		
	Present HAT	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.3 m	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.8 m	1 in 100 Storm Tide	Erosion Prone Area
Natural Area Zones (Environmental Management & Conservation)	●	●	●	●	●	●	●	●	●
Rural; Rural Residential; Open Space; Recreation Zones	●	●	●	●	●	●	●	●	●
Residential Area Zones (Emerging Communities; High, Medium & Low Density Residential)	●	●	●	●	●	●	●	●	●
Industrial / Commercial Zones (Neighbourhood, Local, District & Principal Centres; Low, Medium & High Impact Industry; Waterfront and Marine Industry)	●	●	●	●	●	●	●	●	●
Other Development Zones (Community Facilities 1,2, 4 & 5; Limited Development (Constrained Land), Mixed Use)	●	●	●	●	●	●	●	●	●
Matters of National Environmental Significance	●	●	●	●	●	●	●	●	●
Matters of State Environmental Significance	●	●	●	●	●	●	●	●	●
Matters of Local Environmental Significance	●	●	●	●	●	●	●	●	●
Road Infrastructure	●	●	●	●	●	●	●	●	●
Sewerage	●	●	●	●	●	●	●	●	●
Stormwater Infrastructure	●	●	●	●	●	●	●	●	●
Water Supply Infrastructure	●	●	●	●	●	●	●	●	●
Council Buildings		●	●		●	●	●	●	●
Cultural / Other Assets[1]	●	●	●	●	●	●	●	●	●

[1] E.g. heritage assets, recreational boating facilities, emergency services

1.3.2 Report Assumptions and Limitations

- It is important to note that the assessment uses GIS to identify assets in hazard areas. Due to a combination of historical land surveys and shifting shorelines, in some locations, portions of land or road parcels are presently located within the tidal zone. The assessment therefore includes analysis against the current day level of highest astronomical tide to provide context for future sea level changes.
- In some instances, the extent of asset affected is within the order of accuracy of the hazard modelling and/or mapping. For this reason, the extent of assets affected is reported to the nearest hectare or metre.
- The analysis of road assets includes consideration of ownership, road hierarchy and surface type. This information will be applied in the Phase 5 risk assessment. Only formed roads have been included in the Phase 4 reporting.
- Where roads or rail lines have been identified as being impacted due to a gap in the LiDAR data associated with a bridge or culvert, a proxy road or rail level based on the elevation of the road or rail approaches on either side of the gap has been used to assess inundation depths.
- Maximum inundation depths for road assets within each Management Zone are also included to provide context for community impacts and to inform the risk assessment.
- The way that utilities such as water, sewer, gas etc cross waterways varies from location to location. Although this information is not provided in asset data, these crossings can be underground, supported by piers etc, or attached to bridges. The crossing type (and the resultant potential for impacts) is noted where known.
- Inundation depths for building assets have not been reported. While building footprint are available for the local government area, floor levels are required to further understand the implications of inundation on those assets.
- In areas with seawalls, the formal erosion prone area has been applied in this assessment to align with the requirements of the CHAS. It is recognised that there are a wide variety of seawalls of varying standard and condition within the Fraser Coast area. Given that many of the seawalls provide some level of protection against erosion, the present day erosion extent represents the calculated storm “bite” which can be used to refine the understanding of the nature and extent of assets within the present climate potential seawall failure zone.
- The locality of Magnolia, identified in the Phase 2 assessment, has been removed from Management Zone 5 as the modelling and mapping refinement indicates that this area is not impacted by coastal hazards.

2 Management Zone 1 – Burrum Heads

This zone covers the northern coastal portion of the FCRC area, from Burrum River to Beelbi Creek and inland to Howard (refer Figure 2-1). The zone includes the settlements of Burrum Heads, Howard, and Torbanlea.

The Burrum Heads locality covers the Hervey Bay (Coral Sea) frontage between Burrum River and Beelbi Creek. Burrum Heads is a traditional and popular coastal holiday village that supports a relaxed coastal lifestyle and includes seaside caravan parks and holiday houses, recreational boating facilities and small businesses. Located on the southern bank of the mouth of the Burrum River, revetments protect approximately 700 m of riverbank from erosion.

Separated by several km from the main settlement, residential estates are also located on the Hervey Bay frontage of the Burrum Heads locality, midway between Burrum River and Beelbi Creek. The beaches adjacent to residential development are highly valued by the local community, with holiday visitation higher close to the Burrum River mouth.

A section of the Burrum Coast National Park occupies more than half of this locality, stretching from the Burrum River near Buxton, south-east to the mouth of Beelbi Creek.

Cherwell, Burrum River and Beelbi Creek are predominately rural and contain allotments adjacent to either Cherwell River (a tributary of Burrum River), Burrum River or Beelbi Creek.

Pacific Haven is bordered by Cherwell River to the west and Burrum River to the east and is predominantly freehold rural residential. The area fringing the rivers is known to be low-lying and vulnerable to flood inundation.

The settlements of Burrum Town, Torbanlea & Howard border the Burrum River, and are located on the Bruce Highway (and Old Bruce Highway), with Burrum Town and Torbanlea to the south of the Burrum River and Howard to the north. The area contains rural, rural residential and low density residential development with a small commercial area in Howard. There is little growth anticipated for Burrum Town and Torbanlea under the current planning scheme, however Howard offers limited growth opportunities dependent on infrastructure provision.

2.1 General Hazard Impacts

Burrum Heads is the main coastal community within this management zone, and this locality covers the Hervey Bay frontage from the mouth of the Burrum River to the mouth of Beelbi Creek. The bay frontage's beaches, low profile dune and beach ridge plains are subject to open coast erosion and inundation from sea level rise and storm tide, and most of the coastal hazard impacts in the management zone occur in this locality. These beaches are fronted by relatively wide inter-tidal sand flats. Close to the mouth of the Burrum River residential development has encroached on the dune, resulting in a very narrow and low elevation dune fronted by a rock revetment with very little recreational beach width available at higher tides. Immediately to the south, although the dune width has been preserved, it has been mowed and vegetation selectively removed for residential views. South of Orchid Drive to Beelbi Creek, the dune system is largely undeveloped, and although low, is well-vegetated and able to fluctuate naturally in response to storm events.

Low and medium density residential areas at Burrum Heads are impacted by all coastal hazards under all climates, with just the seaward/riverfront fringe of parcels impacted by present climate HAT. Areas impacted increase notably under storm tide scenarios, particularly by 2100. Areas zoned as Emerging Communities are within all hazard extents under all climates at Burrum Heads, with areas adjacent to Bushnell Road and south of Orchid Drive affected.

Land zoned as Community Facilities 2 includes the wetland at Riverview Drive, which along with the adjacent open space parcel, is affected by all coastal hazards under all climates. The Burrum Heads Sewage Treatment Plant site is also zoned as Community Facilities 2 and is within the 2100 storm tide extent.

Commercial premises zoned as Local Centre (main commercial precinct in Burrum Heads village) and District Centre (Burrum Heads Road near the Burrum Heads Hotel) are within storm tide hazard extents under the present climate and 2050 future climate respectively.

Impacts within the riverine frontage of this management area are confined to the fringes of Beelbi Creek, Burrum River and its tributaries (Isis and Cherwell Rivers) and, with erosion extents associated with estuarine channel migration or projected sea level rise inundation on low-lying sections of the waterways.

Built development along the Burrum River upstream of Burrum Heads is localised and within the Fraser Coast area is centred around Pacific Haven, Burrum Town and Howard. In places where the river channel is very well defined, inundation impacts from sea level rise and storm tide are largely confined within the existing river channel. Burrum Weir just upstream of the town of Howard limits the intrusion of tidal movements further upstream.

Large areas of low-lying land presently zoned as Rural in the Burrum Heads, Burrum River and Beelbi Creek localities are within hazard extents, particularly from HAT and storm tide impacts under all climates associated with inundation from Beelbi Creek and along the Burrum River frontage.

Rural residential zoned areas in Pacific Haven and rural zoned areas in Cherwell experience notable impacts from erosion hazard extents under all climates, with Cherwell also progressively impacted by storm tide.

2.2 Natural Areas and Matters of Environmental Significance

A large portion of the Burrum Coast National Park is impacted by all coastal hazards under all climates, particularly adjacent to Beelbi Creek. The beachfront Esplanade from Burrum Heads village to Beelbi Creek mouth is area also exposed to these hazards and is similarly zoned as Environmental and Conservation or Open Space.

Nearly the entire riverine or coastal frontage of this management zone is covered by mapping denoting it as containing a Matter of State Environmental Significance (MSES). This includes all beach and waterway areas as well as the adjacent lands. Dominating the assessment are areas of high ecological value watercourse and regulated vegetation intersecting a watercourse, of which substantial areas are within the extent of present climate HAT. The impacts on MSES areas increases notably for all hazards over time, but particularly for regulated vegetation.

No areas of National Environmental Significance within the Management Zone are impacted.

2.3 Council Infrastructure Assets

Local sealed and unsealed roads are mainly impacted by storm tide, with many affected by storm tide under all climates, particularly the residential area close to the ocean frontage of Burrum Heads Beach. In addition to storm tide impacts, notable roads impacted by HAT include Burrum Street (inundation depth up to 0.7 m by 2100 HAT) and Orchid Drive (inundation depth up to 0.5 m affected by 2100 HAT) at Burrum Heads and Pacific Haven Circuit at Pacific Haven (inundation depth of nearly 0.3 m by 2100 HAT).

The Burrum Heads Sewage Treatment Plant site is within the 2050 storm tide hazard extent, and 2100 HAT and erosion prone area. These storm tide hazards also impact on the effluent reuse pipeline as it exits the facility.

Varying extents of water, sewer and stormwater infrastructure servicing residential and commercial properties within the community of Burrum Heads are within most hazard extents over all climates, including sewer gravity mains, pump stations, drains, stormwater pipes, and water mains. The footprint of the Burrum Heads Water Reservoir is within the 2100 storm tide hazard extent, as is the associated pump station. The Burrum Weir and associated water pump station are within storm tide or erosion hazard extents by 2100.

Seawall and groyne assets along the Burrum Heads riverine foreshore are impacted by all hazards under all climates (note that groynes are included in Council's asset layers as a two-sided seawall). Also impacted are beach access structures (ramps, stairs and beach tracks), boat ramps (including those along Burrum River) and the floating walkway at the Lions Park Boat Ramp.

Burrum Heads Beachfront Tourist Park is within storm tide and erosion hazard extents for all climates. The Burrum Heads Library is within the storm tide hazard extents for all climates, and the 2100 HAT and erosion prone area extents. The Burrum Heads Transfer Station site is impacted by 2100 storm tide, although actual infrastructure may not be positioned within the hazard extent.

2.4 Other Assets

Two State controlled roads were identified as being impacted by coastal hazards, with inundation impacts affecting Burrum Heads Road (all storm tide and erosion and 2100 HAT) and Pialba Burrum Heads Road at the Beelbi Creek crossing (erosion from 2050 onwards and 2100 storm tide).

Parts of these roads are also evacuation routes.

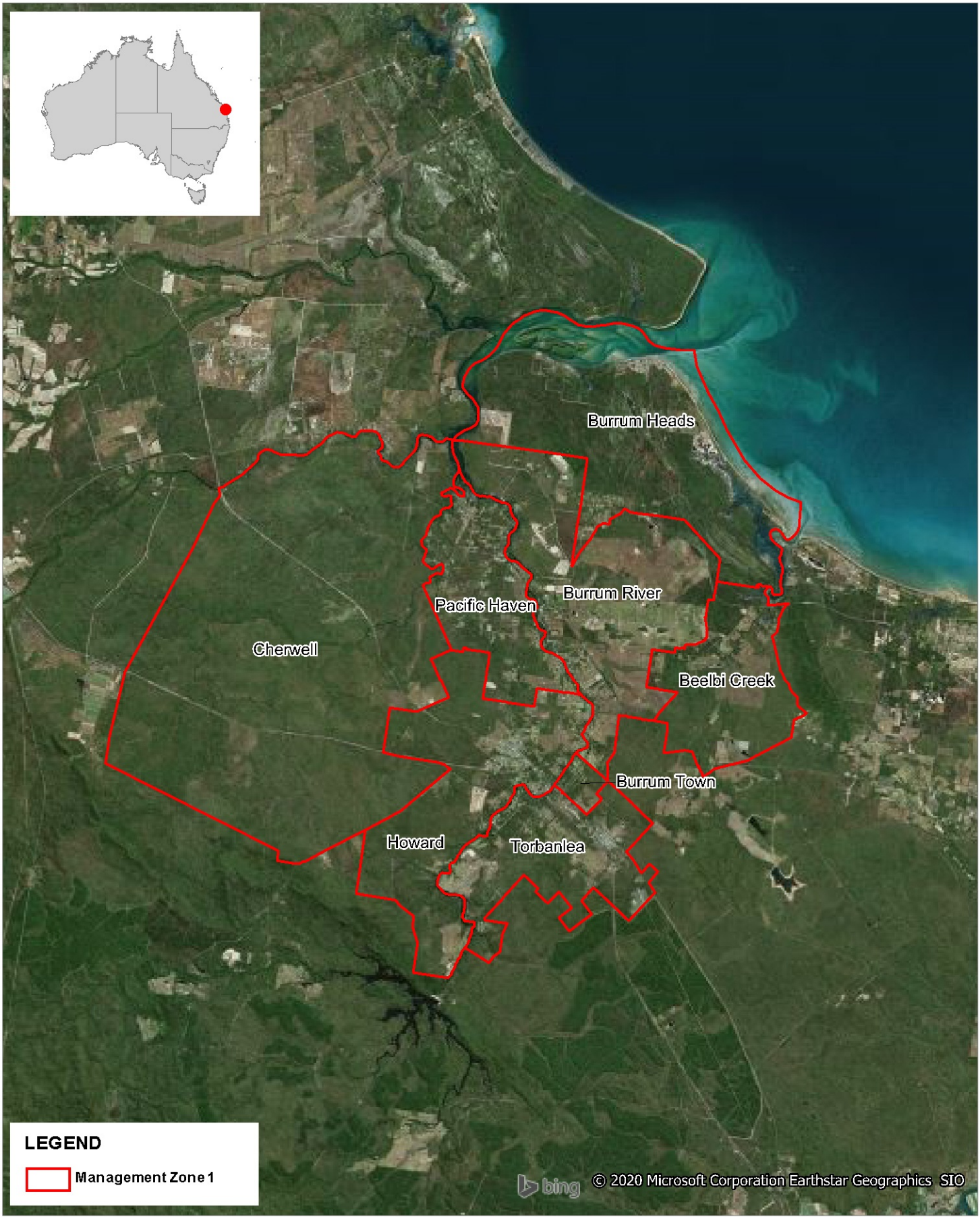
A gas main is within storm tide hazard extents at the Bruce Highway crossing of the Burrum River. No elevation data for gas mains was available.

The rail crossing of the Burrum River several hundred metres downstream of the Bruce Highway crossing is within the future climate (2050 and 2100) erosion prone area extents.

The Burrum Heads Fire Station is within the storm tide hazard area for all climates.

Residential buildings dominate the building footprints impacts and are mainly at Burrum Heads. Buildings identified as being within the extent of the present climate HAT are largely within the caravan park at Burrum Heads, and on riverfront properties at Pacific Haven. Burrum Heads Post Office is impacted by 2050 and 2100 storm tide and 2100 erosion hazard extents.

The fringes of Burrum River Caravan Park at Howard and Hillcrest Holiday Park at Burrum Heads are within all hazard extents for all climates.



Title:

Fraser Coast CHAS Management Zone 1

Figure: 2-1

Rev: A

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Approx.Scale

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Table 2-1 Management Zone 1 – Burrum Heads – Hazard Overview

Asset Class	Present Climate (2019-2030)			2050 Future Climate			2100 Future Climate		
	Present HAT	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.3 m	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.8 m	1 in 100 Storm Tide	Erosion Prone Area
Natural Areas	●	●	●	●	●	●	●	●	●
Rural / Open Space / Recreation	●	●	●	●	●	●	●	●	●
Residential Areas	●	●	●	●	●	●	●	●	●
Industrial / Commercial		●			●		●	●	●
Other Development	●	●	●	●	●	●	●	●	●
Matters of National Environmental Significance									
Matters of State Environmental Significance	●	●	●	●	●	●	●	●	●
Road Infrastructure	●	●	●	●	●	●	●	●	●
Sewerage	●	●	●	●	●	●	●	●	●
Stormwater Infrastructure	●	●	●	●	●	●	●	●	●
Water Supply Infrastructure	●	●	●	●	●	●	●	●	●
Council Buildings		●			●		●	●	●
Cultural / Other Assets	●	●	●	●	●	●	●	●	●

Table 2-2 Management Zone 1 – Burrum Heads – Vulnerable Assets

Asset Class	Present Climate (2019-2030)			2050 Future Climate			2100 Future Climate		
	Present HAT	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.3 m	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.8 m	1 in 100 Storm Tide	Erosion Prone Area
Land Zoning									
Community Facilities 2 (ha)	2.5	41.5	3.8	16.2	44.0	16.9	37.4	44.2	37.7
Community Facilities 5 (ha)	-	<0.1	-	-	<0.1	-	<0.1	<0.1	<0.1
District Centre (ha)	-	-	-	-	<0.1	-	-	<0.1	-
District Centre (parcel count)	-	-	-	-	*1*	-	-	*1*	-
Emerging Communities (ha)	7.0	26.9	8.9	9.2	27.0	10.9	21.4	27.1	21.5
Emerging Communities (parcel count)	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*
Environmental Management & Conservation (ha)	501.0	810.8	562.7	604.7	827.8	653.8	753.5	847.4	805.4
Local Centre (ha)	-	0.3	-	-	0.3	-	<0.1	0.3	0.1
Local Centre (parcel count)	-	*5*	-	-	*7*	-	*2*	*7*	*7*
Low Density Residential (ha)	<0.1	47.7	4.0	0.5	62.4	7.9	38.4	69.2	52.1
Low Density Residential (parcel count)	*8*	*393*	*109*	*69*	*622*	*217*	*235*	*649*	*366*
Medium Density Residential (ha)	<0.1	0.1	0.1	<0.1	0.2	0.2	0.1	1.1	1
Medium Density Residential (parcel count)	*1*	*1*	*1*	*1*	*4*	*3*	*1*	*4*	*3*
Open Space (ha)	0.6	27.5	5.0	6.8	37.7	11.6	18.4	38.2	21.2
Rural (ha)	71.4	496.9	165.5	159.5	551.8	279.8	391.4	597.8	493.4
Conservation and natural environments	*2.1*	*114.8*	*20.7*	*16.4*	*122.3*	*35.8*	*95.1*	*124.1*	*103.3*
Intensive Uses	*16.2*	*71.2*	*31.9*	*37.1*	*81.7*	*54.3*	*61.1*	*90.5*	*80.0*
Irrigated seasonal horticulture	*<0.1*	*0.1*	*0.3*	*0.1*	*0.2*	*0.6*	*0.1*	*0.9*	*1.2*
Grazing native vegetation	*17.0*	*265.5*	*67.3*	*64.4*	*301.0*	*142.3*	*190.9*	*335.1*	*261.6*
Wetlands, reservoirs and rivers	*36.1*	*45.2*	*45.3*	*41.6*	*46.7*	*46.9*	*44.1*	*47.2*	*47.3*
Rural Residential (ha)	7.1	38.6	20.1	11.8	45.7	32.7	28.5	55.8	50.2

Management Zone 1 – Burrum Heads

Asset Class	Present Climate (2019-2030)			2050 Future Climate			2100 Future Climate		
	Present HAT	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.3 m	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.8 m	1 in 100 Storm Tide	Erosion Prone Area
Rural Residential (parcel count)	*91*	*156*	*138*	*130*	*156*	*146*	*151*	*156*	*156*
Matters of State Environmental Significance[2]									
Fish Habitat Areas (ha)	1985.9	2192.6	2028.5	2057.1	2220.7	2089.5	2158.8	2277.8	2205.0
High Ecological Significance (HES) Wetlands (ha)	590.4	827.3	667.0	689.1	866.4	739.1	798.4	1142.0	847.9
High Ecological Value (HEV) Waters-Watercourse (m length) (ha)	25192	37730	28970	35593	37882	36427	36205	37990	38002
High Ecological Value (HEV) Waters-Wetlands (ha)	1261.1	1352.8	1314.1	1326.5	1355.7	1347.9	1340.7	1357.6	1358.1
Protected Area Estates (ha)	376.9	597.2	398.6	442.1	641.2	466.7	551.3	918.9	605.4
Protected Area Nature Refuges (ha)	8.9	17.9	11.8	10.9	19.5	14.2	16.8	23.5	18.8
Regulated Vegetation, Category B Endangered or of Concern (ha)	38.5	319.4	111.6	118.0	397.7	211.7	251.8	710.8	410.3
Regulated Vegetation, Category C Endangered or of Concern (ha)	1.4	19.2	4.2	4.4	25.4	10.1	13.7	44.8	22.4
Regulated Vegetation, Category R GBR Riverine (ha)	12.2	17.6	17.6	17.6	17.6	17.6	17.6	17.6	17.6
Regulated Vegetation, Essential Habitat (ha)	469.9	952.5	572.7	604.3	1132	706.9	838.9	1745.4	994.0
Regulated Vegetation, Intersecting a watercourse (m length)	23634	47161	34487	35027	52471	43910	42552	61952	52197
Wildlife Habitat, Threatened & Special Least Concern (ha)	1652.9	1908.9	1690.2	1719.8	2024.6	1758.7	1853.0	2498.7	1915.5
Beaches									
Ocean Beach (ha)	Entire Burrum Heads Beach frontage								
Estuarine Beach (ha)	Entire Burrum & Cherwell River frontage, Beelbi Creek northern frontage								

[2] Matters of State Environmental Significance includes wetland areas that may be outside of the local government boundary analysed, including tidal areas. The reported areas may also overlap.

Management Zone 1 – Burrum Heads

Asset Class	Present Climate (2019-2030)			2050 Future Climate			2100 Future Climate		
	Present HAT	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.3 m	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.8 m	1 in 100 Storm Tide	Erosion Prone Area
Road Infrastructure									
Sealed Road – Main Road (m length)	-	265	57	-	487	90	21	1590	344
Sealed Road – Main Road (m depth)	-	0.4	N/A	-	0.9	N/A	0.1	2.1	N/A
Sealed Road (m length)		6457	806	694	15015	2053	2744	23695	4689
Sealed Road (m depth)		1.1	N/A	0.4	1.7	N/A	0.9	2.9	N/A
Unsealed Road (m length)	3	1051	14	18	1062	34	1046	1075	1061
Unsealed Road (m depth)	0.1	1.3	N/A	0.4	1.8	N/A	0.9	2.9	N/A
Evacuation Route (m length)		648	63	-	994	80	-	4349	261
Evacuation Route (m depth)	-	0.1	N/A	-	0.5	N/A	-	1.6	N/A
Rail									
Rail network (m length) Error! Bookmark not defined.	-	-	-	-	-	42	-	-	205
Sewerage									
Effluent Main (m length)	-	-	-	-	525	-	-	1887	-
Effluent Manhole, Meter, Value (count)	-	-	-	-	3	-	-	5	-
Gravity Main (m length)	53	4856	345	436	10001	1567	2944	21567	5535
House Connections (m length)	-	678	48	27	1357	243	455	3192	756
Manhole, Valve (m length)	-	81	7	10	179	30	55	484	103
Pump Stations (count)	-	5	-	1	7	1	4	9	4
Treatment Plant (count)	-	-	-	-	1	-	1	1	1
Stormwater Infrastructure									
Drains (m length)	80	1388	289	580	3035	605	1123	3995	1124
Gross Pollutant Traps (count)	-	3	-	1	4	1	1	6	1
Pipes (m length)	346	5493	622	1113	11626	2012	2810	15962	3556

Management Zone 1 – Burrum Heads

Asset Class	Present Climate (2019-2030)			2050 Future Climate			2100 Future Climate		
	Present HAT	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.3 m	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.8 m	1 in 100 Storm Tide	Erosion Prone Area
Pits (count)	17	207	27	40	444	76	123	659	145
Detention structures (count)	1	5	1	1	6	1	4	7	4
Water Supply Infrastructure									
AMR Logger (count)	-	184	41	20	489	83	108	1039	231
Conduit (m length)	-	397	297	243	930	333	268	1361	419
Connections (m length)	-	2006	299	139	5356	563	971	9480	1865
Hydrants (count)	-	55	9	5	154	20	28	278	52
Mains (m length)	545	8816	1781	1773	18547	3326	6122	33668	8714
Meters (count)	-	184	41	20	490	83	108	1043	231
Miscellaneous Water Assets (count)	-	-	-	-	-	-	-	4	-
Pump Stations (count)	-	-	-	-	-	-	-	2	-
Storage (count)	-	-	-	-	-	-	-	1	1
Tanks (count)	-	4	1	-	15	2	3	23	7
Valves (count)	3	45	4	6	93	17	25	183	32
Other Infrastructure									
Electrical Other (count)	18	55	27	27	61	52	53	61	59
Gas Mains (m length) Error! Bookmark not defined.Error! Bookmark not defined.	-	166	-	-	217	-	16	263	370
Other Assets									
Seawalls (m)	1454	1454	1454	1454	1454	1454	1454	1454	1454
Beach Access (count)	3	11	17	4	15	17	11	17	17
Boat Ramps (count)	7	7	7	7	7	7	7	7	7
Jetties and Piers (count)	1	1	1	1	1	1	1	1	1
Public Amenities (count)	-	3	1	1	4	1	1	4	3

Management Zone 1 – Burrum Heads

Asset Class	Present Climate (2019-2030)			2050 Future Climate			2100 Future Climate		
	Present HAT	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.3 m	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.8 m	1 in 100 Storm Tide	Erosion Prone Area
All Buildings (count)	11	416	115	33	830	257	221	1721	565
Caravan Parks (count)	2	4	3	4	4	4	4	4	4
Emergency Services (ha)	-	1	-	-	1	-	-	1	-
Council Land (ha)	36.1	134.2	57.6	67.7	181.2	85.1	114.4	241.3	136.5
Clubs (count)	-	-	-	-	-	-	-	1	-
Burrum Heads Library	-	1	-	-	1	-	1	1	1
Burrum Heads Transfer Station	-	-	-	-	-	-	-	1	-

3 Management Zone 2 – Toogoom to Dundowran Beach

This zone covers the central coastal portion of the FCRC area, from Toogoom to Dundowran Beach and inland to Takura and Walligan (refer Figure 3-1).

Toogoom is a traditional coastal holiday village that supports a relaxed coastal lifestyle and includes residential properties, seaside holiday accommodation and small commercial facilities. The Toogoom township is located on the southern bank of the mouth of Beelbi Creek. Aside from sections of rock revetment, a 50 to 100 m wide vegetated dune system provides a present-day buffer to erosion.

Craignish and Dundowran Beach have a unique character which features park residential style living on predominantly 1-acre allotments that are maintained at a high quality and which include significant vegetation retention.

Dundowran Beach also features a lagoon system (including Arkarra lagoons) within the developed area. The eastern part of Dundowran is currently undeveloped and features land formerly used for grazing/agricultural purposes though with a significant riparian zone along the foreshore and some significant wetland and vegetated areas. Craignish benefits from extensive sea views due to its high location and hilly topography and includes a small commercial centre with a restaurant/café, convenience store and post office.

Located inland of the open coast, Walligan is predominantly national park (Vernon Conservation Park), Takura is largely rural, and Dundowran is a mixture of rural, residential, and rural residential.

3.1 General Hazard Impacts

Similar to Burrum Heads, the Toogoom to Dundowran Beach frontage between Beelbi and Eli Creeks consist of low profile dunes backed by beach ridge plains which are subject to open coast erosion and inundation from sea level rise and storm tide. Wetlands associated with Beelbi and Eli Creeks extend well into the beach ridge plains and are a conduit for tidal inundation into the swales between the beach ridges.

At Toogoom, the spit is fully developed with residential/holiday housing and has been stabilised by a rock revetment. There is no dune formation or high tide beach. South of Beelbi Creek to Eli Creek, the dune is generally wide and fronted by a sandy beach popular with local residents, providing a buffer against storm erosion but not inundation. The exception is a section of beach near Kingfisher Parade, where a seawall has been constructed seaward of private residential properties. The fringe of the Toogoom local centre zoning is impacted by 2050 and 2100 storm tide, and the neighbourhood centre zoning under all hazards and climates except for present climate HAT.

Low density residential and rural residential development close to the bay shoreline throughout this Management Zone is within all hazard extents and climates except for present climate HAT. The seaward extents of some land parcels at Toogoom and Craignish are within present climate HAT.

Rural residential development is also located close to (future) tidal reaches of Stockyard and Black Swamp Creeks, which flow to the Susan River, and O'Regan Creek, which flows into Hervey Bay at Toogoom/Craignish.

A large area zoned as Emerging Communities in Dundowran Beach lies on the beachfront between the existing urban development footprint and Eli Creek. This area includes land within the present climate HAT extent.

Large extents of rural land are impacted by coastal hazards via Beelbi, O'Regan and Eli Creeks, including extensive areas at Toogoom and Craignish impacted by present climate HAT. Aside from conservation purposes, rural land uses are dominated by grazing and farm infrastructure, with several areas used for quarrying.

3.2 Natural Areas and Matters of Environmental Significance

Large areas of land zoned as Open Space or Environmental Management and Conservation situated along the open coast beachfront, surrounding O'Regan Creek in Craignish (O'Regan Creek Conservation Park) and in low-lying areas adjacent to Beelbi Creek in Toogoom are impacted under all hazards and climates. Smaller areas bordering Eli Creek in Dundowran Beach are mainly impacted by storm tide under all climates.

Hazard extents in and around the beachfront as well as O'Regan and Beelbi Creeks are also identified as containing numerous MSES attributes, most of which are contained within the present climate HAT extent. Large additional extents of regulated vegetation, wildlife habitat and high significance wetlands are impacted under storm tide and future climates.

3.3 Council Infrastructure Assets

Local roads around Beelbi and O'Regan Creeks are heavily impacted by storm tide under all climates, with most streets in Toogoom and Dundowran affected by the 2100 storm tide, many of which by more than 1m of inundation. Important roads in Dundowran impacted by the 2050 storm tide include Sempfs and Ansons Roads.

The analysis identified sea level rise impacts by 2050 on roads including Castles Road South, Moreton Street, Pacific Promenade and Toogoom Road, while erosion extents are largely confined to streets close to the open coast frontage, such as Kingfisher Parade, Moreton Street and Toogoom Road.

Toogoom Landfill is impacted by storm tide under the 2050 and 2100 future climates, although actual infrastructure may not be positioned within the hazard extents.

Sewer infrastructure at Toogoom is impacted by storm tide and erosion hazard extents under all climates, with the effluent reuse facility impacted by storm tide by 2050.

Water and stormwater assets are impacted throughout the residential communities of Toogoom, Craignish, Dundowran and Dundowran Beach, including the water main crossing the present climate HAT extents of O'Regan Creek at Toogoom.

Rock seawalls, a small jetty and a boat ramp at Toogoom are impacted by all coastal hazards under all climates. Several sets of beach stairs and formal beach access tracks are also within hazard extents.

3.4 Other Assets

State controlled Pialba Burrum Heads Road road is assessed as being impacted at the crossings of Beelbi and O'Regan Creeks. The assessment indicates that up to 0.4m of inundation depth impacts on Pialba Burrum Heads Road under present climate HAT. This road is also an evacuation route.

The Toogoom Rural Fire Brigade premises is within the 2050 and 2100 storm tide, and 2100 erosion hazard extent.

Located on Toogoom Spit, Serenity Caravan Park is within the storm tide and erosion hazard extents for all climates. A short section of gas main in Walligan is within the storm tide hazard extent under all climates, and all 2100 coastal hazard extents where the main crosses Stockyard Creek on Maryborough Hervey Bay Road.

Numerous buildings are within the hazard extents and are mainly associated with the low density residential and rural residential development close to the open coast shoreline and creek systems throughout this Management Zone.

Title:

Fraser Coast CHAS Management Zone 2

Figure: 3-1

Rev: A

BMT WBM endeavours to ensure that the information provided in this map is correct at the time of publication. BMT WBM does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

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Approx.Scale

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Table 3-1 Management Zone 2 – Toogoom to Dundowran Beach – Hazard Overview

Asset Class	Present Climate (2019-2030)			2050 Future Climate			2100 Future Climate		
	Present HAT	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.3 m	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.8 m	1 in 100 Storm Tide	Erosion Prone Area
Natural Areas	●	●	●	●	●	●	●	●	●
Rural / Open Space / Recreation	●	●	●	●	●	●	●	●	●
Residential Areas	●	●	●	●	●	●	●	●	●
Industrial / Commercial		●	●	●	●	●	●	●	●
Other Development	●	●	●	●	●	●	●	●	●
Matters of National Environmental Significance									
Matters of State Environmental Significance	●	●	●	●	●	●	●	●	●
Road Infrastructure	●	●	●	●	●	●	●	●	●
Sewerage		●	●		●	●		●	●
Stormwater Infrastructure	●	●	●	●	●	●	●	●	●
Water Supply Infrastructure	●	●	●	●	●	●	●	●	●
Council Buildings									
Cultural / Other Assets	●	●	●	●	●	●	●	●	●

Table 3-2 Management Zone 2 – Toogoom to Dundowran Beach – Vulnerable Assets

Asset Class	Present Climate (2019-2030)			2050 Future Climate			2100 Future Climate		
	Present HAT	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.3 m	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.8 m	1 in 100 Storm Tide	Erosion Prone Area
Land Zoning									
Community Facilities 2 (ha)	0.4	0.6	0.4	0.5	0.6	0.5	0.5	0.6	0.6
Emerging Communities (ha)	8.3	139.3	13.0	29.0	146.6	39.3	95.8	148.2	116.9
Emerging Communities (parcel count)	2	13	7	5	13	9	12	14	13
Environmental Management & Conservation (ha)	882.5	934.1	909.9	890.7	944.7	923.1	912.1	948.6	940.7
Local Centre (ha)	-	-	-	-	<0.1	-	-	<0.1	-
Local Centre (parcel count)	-	-	-	-	1	-	-	1	-
Low Density Residential (ha)	0.4	22.9	12.9	1.6	59.2	17.3	5.5	84.4	45.5
Low Density Residential (parcel count)	69	425	252	83	852	337	165	951	597
Medium Impact Industry (ha)	-	-	-	-	-	-	-	0.1	-
Medium Impact Industry (parcel count)	-	-	-	-	-	-	-	1	-
Neighbourhood Centre (ha)	-	0.2	0.2	<0.1	0.2	0.3	0.1	0.3	0.3
Neighbourhood Centre (parcel count)	-	3	3	2	3	3	3	3	3
Open Space (ha)	20.4	47.3	24.7	25.1	51.3	34.2	33.7	56.3	42.3
Rural (ha)	269.8	1038.7	295.2	566.5	1141.2	589.5	920.8	1149.3	937.9
Conservation and natural environments	*132.1*	*401.5*	*143.6*	*182.4*	*447.0*	*193.8*	*348.5*	*451.2*	*359.6*
Intensive Uses	*50.7*	*243.2*	*58.1*	*117.4*	*266.2*	*125.3*	*209.2*	*269.7*	*213.7*
Cropping	-	*1.6*	-	-	*13.3*	-	*1.1*	*13.3*	*1.1*
Irrigated hardwood plantation forestry	-	*3.8*	-	-	*3.8*	-	*2.9*	*3.8*	*2.9*
Grazing native vegetation	*65.1*	*356.0*	*69.2*	*243.7*	*377.9*	*245.7*	*334.8*	*378.1*	*335.3*
Wetlands, reservoirs and rivers	*21.9*	*32.7*	*24.3*	*23.0*	*33.0*	*24.9*	*24.4*	*33.3*	*25.4*
Rural Residential (ha)	3.5	24.6	4.4	6.1	37.5	9.8	17.9	39.6	29.0

Management Zone 2 – Toogoom to Dundowran Beach

Asset Class	Present Climate (2019-2030)			2050 Future Climate			2100 Future Climate		
	Present HAT	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.3 m	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.8 m	1 in 100 Storm Tide	Erosion Prone Area
Rural Residential (parcel count)	10	56	28	17	86	37	36	86	73
Sport & Recreation (ha)	2.4	33.7	2.5	5.4	33.9	5.4	27.4	33.9	27.4
Matters of State Environmental Significance[3]									
Fish Habitat Areas (ha)	524.0	545.4	544.9	533.6	546.5	546.5	540.6	547.4	547.4
High Ecological Significance (HES) Wetlands (ha)	188.1	475.3	198.2	318.9	521.4	326.4	456.9	583.2	458.6
High Ecological Value (HEV) Waters-Watercourse (m length)	28	28	28	28	28	28	28	28	28
High Ecological Value (HEV) Waters-Wetlands (ha)	82.7	87.7	87.7	85.0	87.7	87.7	87.5	87.7	87.7
Protected Area Estates (ha)	49.9	57.5	58.2	52.5	59.0	59.5	55.7	60.6	59.9
Protected Area Nature Refuges (ha)	-	-	-	-	-	-	-	-	-
Regulated Vegetation, Category B Endangered or of Concern (ha)	78.7	188.3	87.1	114.5	216.3	122.6	174.0	280.5	181.7
Regulated Vegetation, Category C Endangered or of Concern (ha)	12.4	24.7	13.1	16.8	26.9	16.9	22.1	30.3	22.1
Regulated Vegetation, Category R GBR Riverine (ha)	20.4	23.2	23.2	23.2	23.2	23.2	23.2	23.2	23.2
Regulated Vegetation, Essential Habitat (ha)	277.3	653.8	330.4	435.5	726.6	487.1	598.9	861.1	641.6
Regulated Vegetation, Intersecting a watercourse (m length)	4516	10667	5206	5659	13337	6416	9646	17574	10303
Wildlife Habitat, Threatened & Special Least Concern (ha)	637.9	926.3	660.7	767.1	986.7	789.9	890.0	1094.0	910.5
Beaches									
Ocean Beach (ha)	Entire Toogoom Beach frontage, majority of Dundowran Beach frontage								

[3] Matters of State Environmental Significance includes wetland areas that may be outside of the local government boundary analysed, including tidal areas. The reported areas may also overlap.

Asset Class	Present Climate (2019-2030)			2050 Future Climate			2100 Future Climate		
	Present HAT	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.3 m	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.8 m	1 in 100 Storm Tide	Erosion Prone Area
Estuarine Beach (ha)	Entire O'Regan Creek frontage, & Beelbi Creek southern frontage								
Road Infrastructure									
Sealed Road – Main Road (m length)	241	1185	758	848	1235	1151	1121	4644	1342
Sealed Road – Main Road (m depth)	0.4	1.4	N/A	0.7	1.8	N/A	1.2	2.7	N/A
Sealed Road (m length)	23	6366	2305	914	17996	3527	2886	40825	7110
Sealed Road (m depth)	0.2	1.3	N/A	0.5	1.7	N/A	1.0	2.6	N/A
Unsealed Road (m length)	614	5029	850	1591	5956	2159	4324	6974	4324
Unsealed Road (m depth)	0.5	1.6	N/A	0.8	2.0	N/A	1.3	2.9	N/A
Evacuation Route (m length)	-	-	58	-	-	90	5	327	142
Evacuation Route (m depth)	-	-	N/A	-	-	N/A	0.2	0.9	N/A
Sewerage									
Effluent Main (m length)	-	-	-	-	722	-	-	1255	-
Effluent Manhole, Meter, Value (count)	-	-	-	-	1	-	-	2	-
Gravity Main (m length)	-	247	16	-	2349	115	-	13110	1822
House Connections (m length)	-	13	2	-	371	15	-	1554	303
Manhole, Valve (count)	-	5	-	-	44	2	-	278	42
Pump Stations (count)	-	2	-	-	3	-	-	9	2
Effluent Reuse Facilities (count)	-	-	-	-	1	-	-	1	-
Stormwater Infrastructure									
Drains (m length)	2422	7894	2863	3032	10021	3415	6070	12434	6292
Gross Pollutant Traps (count)	1	1	1	1	1	1	1	1	1
Pipes (m length)	138	2450	449	719	7830	1057	1064	20998	1878
Pits (count)	27	179	59	55	389	87	105	927	145

Asset Class	Present Climate (2019-2030)			2050 Future Climate			2100 Future Climate		
	Present HAT	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.3 m	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.8 m	1 in 100 Storm Tide	Erosion Prone Area
Detention structures (count)	1	3	1	1	6	1	2	10	2
Water Supply Infrastructure									
AMR Logger (count)	1	125	167	19	497	199	49	1655	381
Conduit (m length)	-	64	25	16	317	25	16	1382	173
Connections (m length)	7	2330	1909	523	7219	2516	1325	16755	4326
Hydrants (count)	-	29	22	4	128	29	10	428	54
Irrigation (count)	-	-	-	-	-	-	-	1	-
Mains (m length)	295	5917	3683	949	17694	5080	2576	46122	8641
Meters (count)	1	127	167	20	501	200	50	1663	382
Miscellaneous Water Assets (count)	-	1	-	-	2	-	1	6	2
Tanks (count)	-	-	1	-	5	1	-	27	5
Valves (count)	1	21	8	2	69	15	8	207	31
Other Infrastructure									
Electrical (count)	-	4	6	-	7	6	-	8	7
Gas Mains (m length)	-	74	-	-	84	-	74	133	74
Council Land									
Land (ha)	852.2	916.3	873.5	860.2	939.4	891.3	885.1	991.0	916.4
Other Assets									
Beach Access (count)	2	36	46	3	45	47	7	47	48
Boat Ramps (count)	1	1	1	1	1	1	1	1	1
Jetties and Piers (count)	1	1	1	1	1	1	1	1	1
Seawalls (length m)	1180	1180	1180	1180	1180	1180	1180	1180	1180
Public Amenities (count)	-	6	8	-	8	8	1	8	8

Management Zone 2 – Toogoom to Dundowran Beach

Asset Class	Present Climate (2019-2030)			2050 Future Climate			2100 Future Climate		
	Present HAT	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.3 m	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.8 m	1 in 100 Storm Tide	Erosion Prone Area
Emergency Services (count)	-	-	-	-	1		-	1	1
Caravan Parks (count)	-	1	1	-	1	1	1	1	1
All Buildings (count)	8	331	259	37	993	355	122	2869	771
Clubs (count)	1	2	1	2	2	2	2	2	2
Toogoom Landfill					1			1	

4 Management Zone 3 – Eli Waters to Urangan

Management Zone 3 covers the eastern coastal portion of the mainland from Eli Waters to Urangan (refer Figure 4-1).

Centred around Eli Creek, Eli Waters is a largely residential area, supported by retail and occasional tourist accommodation. Recent residential development has incorporated the low-lying areas adjacent to the Creek into residential lagoons and artificial waterways.

Inland of Pialba and Eli Waters, Urraween is a predominantly residential area but also includes hospitals, schools and major shopping centres. Due to distance and topography, the risk to Uraween from coastal hazards is considered low with only a single allotment (reserve) partially within the 2050 and 2100 storm tide hazard extent.

Point Vernon is dominated by residential housing with some tourist accommodation. Situated on a moderately elevated, rocky headland, the area is exposed to inundation hazards on the western shoreline adjacent to Eli Creek.

The Pialba commercial node is the most significant commercial, retail and government agency area in Hervey Bay. Retail and commercial development is focussed along Torquay Road, Main Street and Boat Harbour Drive, which are set back both by distance and topography from the Hervey Bay foreshore. Key educational and cultural facilities such as the University of Sunshine Coast and the Council-owned art gallery, community and cultural centre and library are located along Old Maryborough Road/Torquay Road. Key foreshore development includes the waterpark ‘Wetside’, a caravan park and the Seafront Oval, which is used for sporting and cultural events. There are also significant open space areas associated with Tooan Tooan Creek and a bat colony. Lining the esplanade is a mixture of hotels, permanent residential and holiday houses and apartments, particularly in close proximity to the Esplanade.

The Esplanade at Scarness is picturesque and incorporates active recreation areas along with a caravan park, cafés, restaurants and tourist-related retail. Most built infrastructure is on the landward side of the road, including apartments and tourist accommodation.

Additional commercial, community and light industry premises are located outside of the coastal hazard zone, including Police and fire stations.

At Torquay foreshore development and facilities along the Esplanade support a beach-front café with water sports, tennis courts, a caravan park, sailing club and developed foreshore parkland. The commercial node of Torquay contains a mix of office, retail, restaurants and cafés and is centred on the Esplanade and Bideford Street/Freshwater Street.

Torquay is a popular seaside location and the combination of foreshore parkland and an active Esplanade supports tourist accommodation, catering for upmarket retreats to backpacker-style accommodation. Seawalls built progressively over several decades limit erosion impacts to the Torquay and Urangan areas.

The Urangan Boat Harbour and immediate surrounds is a key coastal-dependent precinct that includes a marina facility, tourist accommodation, club/gaming facility, restaurants/cafés and

speciality retail facing a waterfront boardwalk. The Boat Harbour also includes the Boat Harbour club a large restaurant/function and gaming facility.

The Pier Park precinct is focused around the historical Urangan Pier, which is approximately 1 km long and popular for promenading and recreational fishing. Close to the pier is multi-storey tourist/residential accommodation, along with a hotel, bars, restaurants and retailers. The precinct has a slow traffic environment with a high level of visual amenity, and the adjacent activated parkland is highly valued and heavily utilised for festivals, markets and weekly community running events.

Additional retail areas are located outside of the coastal hazard area.

4.1 General Hazard Impacts

The open coast frontage of this management zone consists of two distinct areas – the rocky and relatively elevated Point Vernon shoreline, and the sandy beaches and low dunes of the Pialba to Urangan shoreline, which is exposed to erosion impacts, but is partially protected by non-contiguous seawalls of variable design standard. These beaches are very popular and well used, particularly towards the central-western end of the embayment.

Where not modified by seawalls, the dune is relatively intact, wide and well vegetated, however contains walking paths and occasional major infrastructure to support active recreational activities. Although still present along most of the embayment, the dune is unable to provide coastal protection functionality where seawalls have been constructed close to the seaward face of the dune, such as at Quota Park immediately east of the Churchill St groyne. In other locations the seawalls have been constructed to directly protect built infrastructure such as roads or urbanised community parkland, with no discernible dune form remaining. Where seawalls have been constructed, there is little to no recreational beach width available at high tide.

Notable creek systems and associated wetlands that support the penetration of tidal influences are Eli and Tooan Tooan Creeks, and other minor Creeks closer to the area around Urangan Boat Harbour.

The majority of built assets are landward of community parkland mainly zoned as Open Space, with intervening parcels zoned for Sport and Recreation. This zoning contains functional dune systems, seawalls, landscaped parkland as well as caravan parks and recreational community infrastructure. The majority of coastal hazards affecting this management zone are captured within these zonings.

The highly urbanised environment landward of the open space zone has a high level of exposure from coastal hazards. Notable areas of land zones for low, medium and high density residential purposes are impacted, with low density residential land parcels at Point Vernon and Eli Waters within the present climate HAT extent.

High and medium density residential areas are impacted by sea level rise in Scarness by 2050, and Urangan by 2100. All localities within the high density residential zone are within the storm tide and erosion hazard extents for all climates, while medium density residential areas are mainly exposed to storm tide impacts. Impacts progressively extend southwards as inundation levels increase.

Land within the District Centre zoning at Urangan is within the 2050 and 2100 storm tide extent, while the Principal Centre zone at Pialba is impacted by all storm tide extents and all coastal hazard extents by 2100.

The large Mixed Use Zone around Urangan Boat Harbour is heavily impacted by all hazards under all climates, largely because the on-water area is included in the zoning.

Two large land parcels zones as Emerging Communities and several parcels zoned as Rural are adjacent to Eli Creek. These parcels are exposed to all hazards under all climates. Constrained land containing the Eli Creek Sewage Treatment Plant is impacted by the 2100 storm tide hazard extent.

Land zoned as Community Facilities 2 at Pialba adjacent to Tooan Tooan Creek houses the Hervey Bay Historical Museum and is within all storm tide and erosion hazard extents, and the 2100 sea level rise extent.

4.2 Natural Areas and Matters of Environmental Significance

Areas zoned as Environmental Management and Conservation are mainly around Eli Creek, the western side of Point Vernon and Pulgul Creek. These areas area also largely mapped as containing MSES. The nature of these areas as wetlands supports their assessment as being exposed to all hazards under all climates.

4.3 Council Infrastructure Assets

Local roads are heavily impacted by storm tide. Around Eli Waters, the local roads are generally only impacted by the 2100 storm tide via Eli Creek. In central Hervey Bay, impacts occur via Tooan Tooan Creek and overtopping of the dune system, with extents progressively penetrating further inland over time. Most roads north of Boat Harbour Drive from Scarness to Urangan are within the 2100 storm tide extent.

More than 250m of Esplanade in the Pialba / Point Vernon area is inundated by the 2050 HAT extent by up to 0.2m. By 2100, the inundation area extent includes part of the Urangan end of the Esplanade, with more than 1.1km of Esplanade impacted by inundation, with depths in places of up to 0.7m.The extent of Esplanade within the erosion hazard extent also progressively increases, although the protection afforded by the existing network of seawalls would be expected to mitigate this to a certain extent.

Large sections of the unsealed Grinsteads and Eli Creek Roads at Eli Waters are within all hazard extents under all climates.

The Pulgul Waste Water Treatment Plant site is impacted by storm tide hazards for all climates and erosion by 2100, however actual infrastructure may not be positioned within the hazard extents. Eli Creek Sewage Treatment Plant is within the 2100 storm tide hazard extent, with ancillary infrastructure such as the effluent main impacted by all hazards under all climates. General sewerage, water supply and stormwater assets are similarly affected, particularly in the densely populated area bordering the Esplanade to the east of Tooan Tooan Creek. Storm tide affects large areas of Urangan and Torquay, with 27 sewer pump stations and 24 stormwater detention structures within the 2100 storm tide hazard extent.

The extensive seawalls and groynes along the length of the beachfront are all impacted by coastal hazards, as are numerous beach access stairs, ramps and tracks. Several boat ramps are within the hazard zones, including several at Urangan State Boat Harbour.

Three important piers are located along this section of foreshore, being Urangan Pier, Torquay Jetty and Scarness Jetty. All are impacted by all coastal hazards. Other popular assets affected include Wetside Water Education Park, which is within all hazard extents, the Stage in Scarness Park, and three Council owned beachfront tourist caravan parks at Pialba, Torquay and Scarness.

4.4 Other Assets

State controlled Pialba Burrum Heads Road is within the 2100 storm tide extent around Eli Creek. A short section of State controlled road within the Urangan State Boat Harbour is also affected by 2100 storm tide.

The Hervey Bay Historical Museum is within all storm tide and erosion hazard extents, and the 2100 sea level rise extent. Other sites of historical significance include remnants of the Urangan Railway, a Milestone at Pialba, Dayman Point Steps, Popp's Pond group of fig trees, Seafront Oval and Urangan Pier. The Pier and Dayman Point Steps are within the present climate HAT extent, while Seafront Oval is within the 2100 sea level rise extent.

Urangan State Boat Harbour is a significant, coastal dependent asset impacted by all hazards under all climates. The storm tide hazard impacts include inundation of the car park, ancillary marina and administration buildings, Volunteer Marine Rescue premises, resort accommodation etc. By 2100, the sea level rise extent affects the fringe of the car park area near the public boat ramps. The entire harbour is protected by seawalls.

Gas mains in the vicinity of the Esplanade and crossing Tooan Tooan Creek are within storm tide and erosion hazard extents under all climates, and within 2100 sea level rise extents.

Impacts on Fibre Optic cables occur largely at the crossings of the upper ends of small coastal creek systems. Telecommunications Cables are similarly affected, except for large extents on the foreshore in the vicinity of Urangan Pier, Hervey Bay Sailing Club, Scarness Jetty and Seafront Oval.

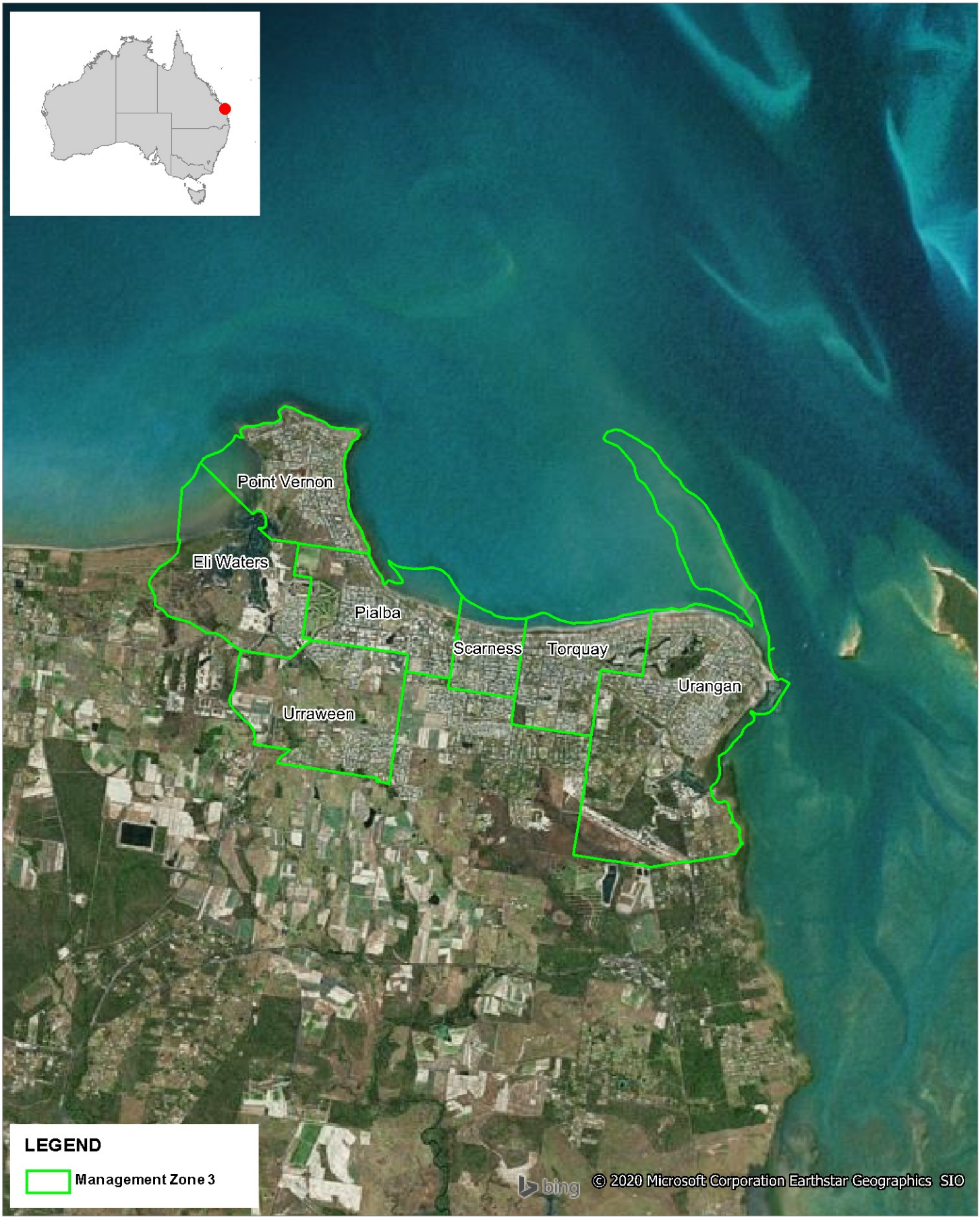
Several other privately owned caravan parks in the management zone are within the 2100 storm tide extent, with the Shelly Beach and Windmill Caravan Parks also within the 2050 storm tide extent.

Community clubs impacted include Hervey Bay and Urangan bowls clubs (2100 storm tide), the Hervey Bay Surf Life Saving Club and the Hervey Bay Sailing Club (most hazards over most climates).

Aged care facilities are impacted, including one on Zephyr St within the present climate storm tide and 2100 sea level rise hazard extents.

Xavier Catholic College at Eli Waters is within the storm tide hazard extent for the 2050 and 2100 future climates.

Fraser Coast mapping includes seawalls around Urangan boat harbour as private assets. The reported length of seawalls includes each side of structures such as groynes and the breakwaters around Urangan Boat Harbour.



Title:

Fraser Coast CHAS Management Zone 3

Figure: 4-1

Rev: A

BMT WBM endeavours to ensure that the information provided in this map is correct at the time of publication. BMT WBM does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

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Table 4-1 Management Zone 3 – Eli Waters to Urangan – Hazard Overview

Asset Class	Present Climate (2019-2030)			2050 Future Climate			2100 Future Climate		
	Present HAT	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.3 m	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.8 m	1 in 100 Storm Tide	Erosion Prone Area
Natural Areas	●	●	●	●	●	●	●	●	●
Rural / Open Space / Recreation	●	●	●	●	●	●	●	●	●
Residential Areas	●	●	●	●	●	●	●	●	●
Industrial / Commercial	●	●	●	●	●	●	●	●	●
Other Development	●	●	●	●	●	●	●	●	●
Matters of National Environmental Significance									
Matters of State Environmental Significance	●	●	●	●	●	●	●	●	●
Road Infrastructure	●	●	●	●	●	●	●	●	●
Sewerage	●	●	●	●	●	●	●	●	●
Stormwater Infrastructure	●	●	●	●	●	●	●	●	●
Water Supply Infrastructure	●	●	●	●	●	●	●	●	●
Council Buildings			●			●		●	●
Cultural / Other Assets	●	●	●	●	●	●	●	●	●

Table 4-2 Management Zone 3 – Eli Waters to Urangan – Vulnerable Assets

Asset Class	Present Climate (2019-2030)			2050 Future Climate			2100 Future Climate		
	Present HAT	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.3 m	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.8 m	1 in 100 Storm Tide	Erosion Prone Area
Land Zoning									
Community Facilities 2 (ha)	6.9	16.8	11.5	9.3	19.0	14.1	17.0	20.7	20.7
Community Facilities 4 (ha)	-	<0.1	-	<0.1	0.2	<0.1	<0.1	0.2	<0.1
District Centre (ha)	-	0.1	-	<0.1	1.2	<0.1	<0.1	1.4	<0.1
District Centre (parcel count)	-	2	-	1	4	1	2	4	2
Emerging Communities (ha)	6.0	25.9	18.8	13.1	28.4	21.8	24.0	28.9	27.2
Emerging Communities (parcel count)	2	2	2	2	2	2	2	2	2
Environmental Management & Conservation (ha)	135.2	148.8	139.3	143.6	151.9	146.8	149.7	153.7	153.8
High Density Residential (ha)	-	9.1	0.5	0.6	30.5	4.4	2.9	38.8	23.7
High Density Residential (parcel count)	-	225	50	25	896	264	78	1159	783
Limited Development (Constrained Land) (ha)	6.4	29.3	8.8	17.2	29.4	17.7	28.5	39.8	28.5
Low Density Residential (ha)	10.6	55.2	16.6	26.9	85.2	33.8	54.6	91.1	63.7
Low Density Residential (parcel count)	8	194	25	54	715	112	212	772	250
Medium Density Residential (ha)	-	3.7	-	1.3	19.5	1.3	3.0	22.5	3.5
Medium Density Residential (parcel count)	-	47	-	10	251	14	35	278	54
Medium Impact Industry (ha)	0.1	0.8	0.9	0.5	1.5	2.1	1.2	2.2	2.5
Medium Impact Industry (parcel count)	5	5	5	5	8	8	6	10	11
Mixed Use (ha)	24.3	25.7	30.4	24.6	28.1	31.7	26.1	33.0	32.3
Open Space (ha)	566.3	616.3	614.9	582.5	673.2	643.6	602.5	687.2	660.4
Principal Centre (ha)	-	0.5	-	-	0.5	-	0.4	0.9	0.4
Principal Centre (parcel count)	-	15	-	-	16	-	14	41	14
Rural (ha)	20.8	56.3	21.7	38.7	62.5	40.4	54.5	62.6	56.4

Management Zone 3 – Eli Waters to Urangan

Asset Class	Present Climate (2019-2030)			2050 Future Climate			2100 Future Climate		
	Present HAT	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.3 m	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.8 m	1 in 100 Storm Tide	Erosion Prone Area
Grazing	*20.8*	*56.3*	*21.7*	*38.7*	*62.5*	*40.4*	*54.5*	*62.6*	*56.4*
Rural Residential (ha)	1.3	2.5	3.0	1.8	3.6	4.9	2.7	4.3	5.6
Rural Residential (parcel count)	7	9	9	9	9	9	9	9	9
Sport & Recreation (ha)	-	1.2	0.2	-	1.3	0.5	1.1	4.2	1.3
Matters of State Environmental Significance[4]									
High Ecological Significance (HES) Wetlands (ha)	64.0	86.2	67.8	77.8	93.7	79.9	86.8	95.4	87.5
High Ecological Value (HEV) Waters-Wetlands (ha)	29.4	30.0	30.1	29.7	30.0	30.1	29.9	30.1	30.1
Regulated Vegetation, Category B Endangered or of Concern (ha)	5.4	20.9	10.4	13.6	23.2	18.4	18.8	27.6	23.3
Regulated Vegetation, Category C Endangered or of Concern (ha)	0.1	15.9	0.2	3.3	27.3	3.4	15.0	31.8	15.2
Regulated Vegetation, Category R GBR Riverine (ha)	3.7	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1
Regulated Vegetation, Essential Habitat (ha)	168.3	237.2	206.3	193.5	260.9	227.0	225.9	280.6	251.9
Regulated Vegetation, Intersecting a watercourse (m length)	5414	8430	5530	7010	11873	7191	8290	13642	8614
Wildlife Habitat, Threatened & Special Least Concern (ha)	105.1	146.5	122.9	120.9	154.8	135.3	138.0	164.9	149.8
Beaches									
Ocean Beach (ha)	Entire Point Vernon to Urangan beach frontage								
Estuarine Beach (ha)	Entire Eli, Tooan Tooan and Pulgul Creek frontages								

[4] Matters of State Environmental Significance includes wetland areas that may be outside of the local government boundary analysed, including tidal areas. The reported areas may also overlap.

Asset Class	Present Climate (2019-2030)			2050 Future Climate			2100 Future Climate		
	Present HAT	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.3 m	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.8 m	1 in 100 Storm Tide	Erosion Prone Area
Road Infrastructure									
Sealed Road – Main Road (m length)	-	-	-	-	-	5	-	10	5
Sealed Road – Main Road (m depth)	-	-	-	-	-	N/A	-	<0.1	N/A
Sealed Road (m length)	-	6871	4092	393	36985	8929	3426	68017	19499
Sealed Road (m depth)	-	1.5	N/A	0.4	2.0	N/A	0.9	2.8	N/A
Unsealed Road (m length)	171	1525	347	667	2255	829	1507	2478	1610
Unsealed Road (m depth)	0.4	1.3	N/A	0.7	1.7	N/A	1.2	2.4	N/A
Private Road (m length)	-	-	-	-	73	-	-	597	-
Private Road (m depth)	-	-	-	-	0.5	-	-	1.2	-
Evacuation Route (m length)	-	-	7	-	15	37	-	581	114
Evacuation Route (m depth)	-	-	N/A	-	0.2	N/A	-	0.9	N/A
Sewerage									
Effluent Main (m length)	525	1979	843	1144	2858	1538	2051	3862	2500
Effluent Manhole, Meter, Value (count)	1	5	3	1	9	3	6	12	7
Gravity Main (m length)	312	5360	2516	661	33948	5379	3620	70839	14968
Manhole, Valve (count)	2	93	38	6	616	80	53	1388	269
House Connections (m length)	-	586	111	38	4959	244	374	10099	1515
Pump Stations (count)	-	1	3	-	13	3	1	27	10
Treatment Plant (count)	-	1	-	-	1	-	1	2	1
Stormwater Infrastructure									
Drains (m length)	887	4707	1129	2077	10388	2385	4647	14146	5165
Gross Pollutant Traps (count)	-	6	4	1	24	5	5	29	7
Pipes (m length)	523	6815	3947	1083	28937	6826	4542	53599	13136

Asset Class	Present Climate (2019-2030)			2050 Future Climate			2100 Future Climate		
	Present HAT	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.3 m	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.8 m	1 in 100 Storm Tide	Erosion Prone Area
Pits (count)	43	308	147	89	1160	259	213	1921	483
Detention structures (count)	-	7	-	1	21	2	5	24	5
Water Supply Infrastructure									
AMR Logger (count)	-	164	47	5	1551	175	112	3953	670
Conduit (m length)	-	-	105	81	-	560	142	30	1626
Connections (m length)	-	-	1883	524	72	14302	1586	1325	29054
Hydrants (count)	-	-	44	17	2	312	44	24	683
Irrigation (count)	-	1	12	-	12	15	2	18	18
Mains (m length)	44	5078	1348	330	32006	4539	3396	67696	14353
Miscellaneous Water Assets (count)	-	2	-	1	5	1	2	10	2
Tanks (count)	-	2	-	-	13	-	1	47	3
Valves (count)	-	40	14	1	267	43	26	561	122
Meters (count)	-	177	55	5	1646	203	118	4297	806
Other Infrastructure									
Electrical other (count)	21	168	303	22	396	492	110	609	596
Fibre Optic Cable (m)	901	1213	2	1576	1749	685	2952	2006	901
Telecommunications Cable (m)	-	1598	2081	2	2861	2724	847	4482	3333
Gas Mains (m length)	-	736	487	-	7498	1108	436	11833	2430
Other Assets									
Seawalls (m length)	8594	8594	8594	8594	8594	8594	8594	8594	8594
Beach Access (count)	2	67	98	4	84	100	21	96	102
Boat Ramps (count)	7	7	7	7	7	7	7	7	7
Jetties and Piers (count)	3	3	3	3	3	3	3	3	3

Management Zone 3 – Eli Waters to Urangan

Asset Class	Present Climate (2019-2030)			2050 Future Climate			2100 Future Climate		
	Present HAT	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.3 m	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.8 m	1 in 100 Storm Tide	Erosion Prone Area
Public Amenities (count)	-	6	11	-	15	16	1	22	20
Heritage (count)	2	3	5	2	4	5	3	6	6
All Buildings (count)	10	333	112	36	2375	267	199	4780	815
Caravan Parks (count)	-	2	3	1	10	3	1	11	3
Wetside Water Education Park	1	1	1	1	1	1	1	1	1
Council Land (Ha)	574.9	638.5	629.2	594.9	719.9	663.0	626.1	767.2	698.7
Hervey Bay Historical Museum	-	1	1	-	1	1	1	1	1
Schools (count)	-	-	-	-	1	-	-	1	-
Clubs (count)	-	1	2	-	3	2	-	5	2
Emergency Services (count)	-	-	-	-	-	1	-	1	1

5 Management Zone 4 – River Heads

This area covers the partially sheltered coastline from Booral to Susan River and associated catchment areas (refer Figure 5-1).

River Heads is a peninsula-shaped settlement located between the water body of Hervey Bay and the confluence of the Mary and Susan Rivers. An important boating facility at the tip of the peninsula is used for recreational boating and for daily ferry and vehicular barge services to Fraser Island.

Development at River Heads is predominantly rural residential or low-density residential. The majority of residential development is well elevated with views towards Fraser Island, with the wide inter-tidal area colonised by a wide mangrove fringe.

Booral, Bunya Creek and Susan River are all predominantly rural. The downstream portion of Susan River is very low-lying and is dominated by mangroves.

The northern extent of Nikenbah is zoned emerging community while the remaining area to the south is predominantly rural. The risk to this locality from coastal hazards is considered low as only very small areas are within storm tide extents via Bunya Creek. Sunshine Acres is a rural residential area.

5.1 General Hazard Impacts

This area is heavily sheltered from the south-east by Fraser Island. Accordingly, the shoreline is fringed by patchy expanses of mangrove with no notable dune formations. The mangroves can attenuate waves and therefore the severity of erosion but have no impact on inundation levels. Inter-tidal beach areas largely comprise silty sediments with exposed areas of cobbles and occasional bedrock, and in general are used far less frequently for active recreation than those in Zone 3, particularly as public access is constrained by geography and land development. There is little to no dry beach at higher tides, and the adjacent landforms are generally low and flat.

The majority of impacts are associated with inundation via Hervey Bay and the river systems. Most urbanised areas are elevated above inundation zones, in the remaining areas future erosion hazard extents are largely influenced by sea level rise. All coastal hazards under all climates impacts on small areas zoned as low density residential fringing the bay shoreline at Booral and River Heads, and areas of rural residential along waterway frontages in Booral and Sunshine Acres (via Stockyard Creek).

A small area of land zoned as Emerging Communities at River Heads is within the 2050 HAT extent, and storm tide and erosion extents over all climates.

Large areas of Open Space are within coastal hazard extents under all climates in Sunshine Acres, mainly bordering the upper reaches of Susan River.

Land zoned as Community Facilities 2 fronting Bunya Creek is used for managing effluent disposal; part of this site is within the extent of present climate HAT.

Rural land impacts are mainly identified within the localities of Bunya Creek and Susan River, with large land areas impacted under all hazards and climates, including present climate HAT. While approximately half of the impacted land is used for either conservation or wetland purposes, most of the remaining affected land is used for grazing.

5.2 Natural Areas and Matters of Environmental Significance

Large areas of River Heads and Susan River are within the Environmental Management and Conservation Zone, with the wetlands dominating these areas precluding other uses. Much of these wetland areas are mapped as MSES, with very large expanses impacted by present climate HAT.

These extents remain relatively stable over all climates at River Heads, and after 2050 at Susan River, most likely due to the proximity of adjacent land uses.

5.3 Council Infrastructure Assets

Most roads within this management zone are generally well elevated and therefore not within HAT or erosion hazard extents for all climates. The exceptions to this are Sea Eagles Road and Ti Tree Road east at Booral, both of which are impacted by HAT by 2100 and present climate storm tide. Other roads impacted by storm tie by 2050 include Baxters Road at Sunshine Acres, and River Heads roads Bengtson Road, Gull Way and Kingfisher Drive.

The Effluent Reuse Facilities in Bunya Creek (Vanderwolf and Bunya) and associated sewerage are impacted by most hazard extents and climates. Small sections of water mains are within all storm tide and 2050 and 2100 erosion hazard extents around Kingfisher Drive and Bengston Road at River Heads.

Stormwater infrastructure impacts are largely confined to the seaward end of drainage lines at River Heads, and localised open drains feeding into the upper parts of the various creek systems.

The boat and barge ramps at River Heads are important to the local community, all are impacted by all hazard extents under all climates.

5.4 Other Assets

Large extents of gas main are within coastal hazard extents, particularly at the crossings of Stockyard and Bunya Creeks.

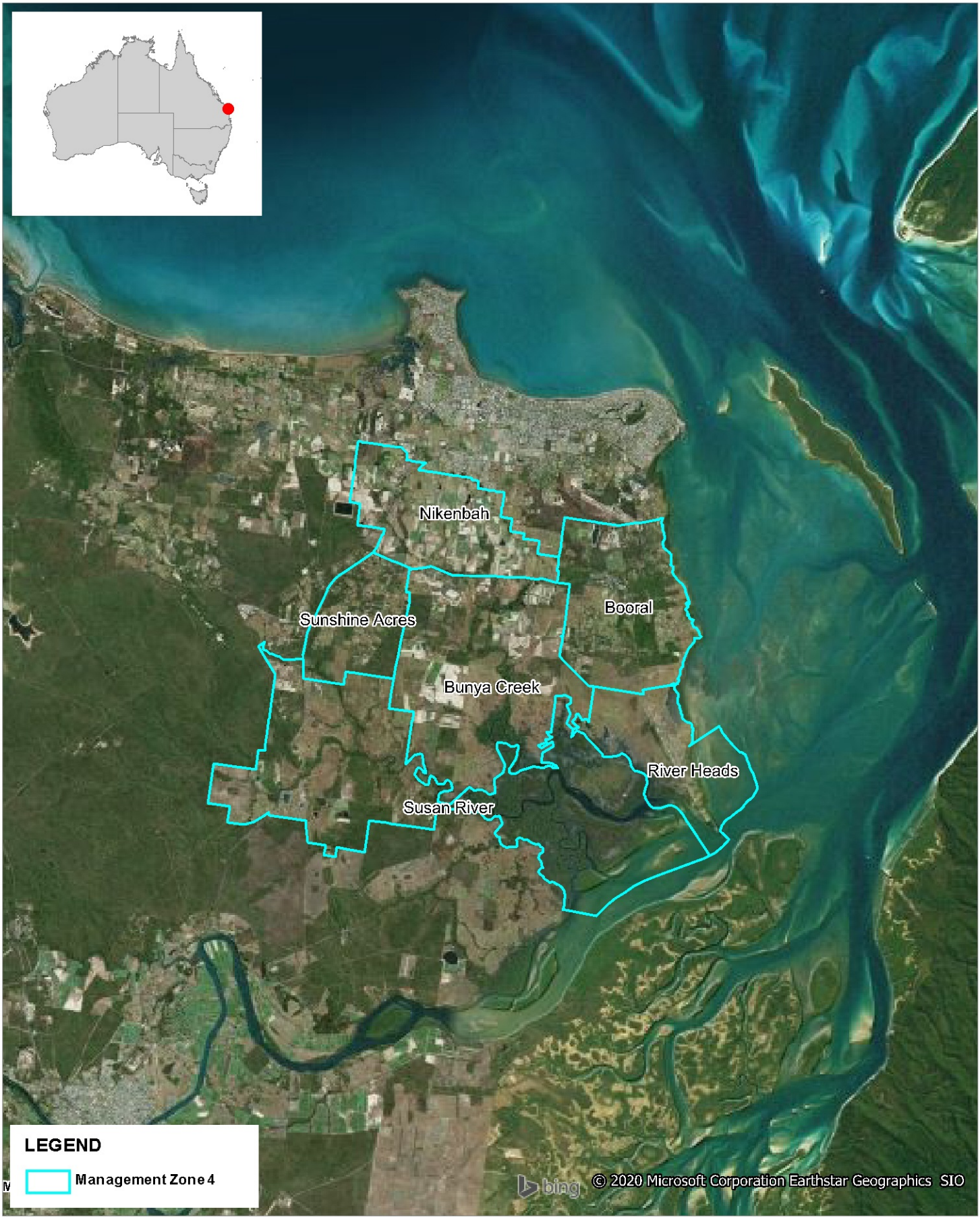
State Controlled Roads in the hazard extent include sections of Booral Road where it crosses Stockyard and Bunya Creeks, and Maryborough Hervey Bay Road at the Susan River crossing. These roads are also evacuation routes. Booral Road is impacted by erosion and storm tide under all climates and Maryborough Hervey Bay Road is impacted by erosion under all climates and storm tide by 2100.

The Fibre Optic Cable alignment cuts across the broad floodplains of the Susan River complex and is within all hazard extents under all climates.

The Booral Homestead Complex site is within all hazard extents under all climates, although it is not clear if there are any built assets of heritage significance on the site.

The Tourist Information Centre at River Heads is within the erosion hazard extent by 2100.

Half of all buildings identified as impacted are associated with rural properties in Susan River, Bunya Creek and Sunshine Acres. Buildings close to the shoreline along Francis and Pelican Avenue at Booral and Kingfisher Parade at River Heads are mainly exposed to storm tide and erosion hazards from 2050 onwards.



Title:

Fraser Coast CHAS Management Zone 4

Figure: 5-1

Rev: A

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Approx.Scale

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Table 5-1 Management Zone 4 – River Heads – Hazard Overview

Asset Class	Present Climate (2019- 2030)			2050 Future Climate			2100 Future Climate		
	Present HAT	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.3 m	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.8 m	1 in 100 Storm Tide	Erosion Prone Area
Natural Areas	●	●	●	●	●	●	●	●	●
Rural / Open Space / Recreation	●	●	●	●	●	●	●	●	●
Residential Areas	●	●	●	●	●	●	●	●	●
Industrial / Commercial						●			●
Other Development	●	●	●	●	●	●	●	●	●
Matters of National Environmental Significance									
Matters of State Environmental Significance	●	●	●	●	●	●	●	●	●
Road Infrastructure	●	●	●	●	●	●	●	●	●
Sewerage	●	●	●	●	●	●	●	●	●
Stormwater Infrastructure	●	●	●	●	●	●	●	●	●
Water Supply Infrastructure		●			●	●	●	●	●
Council Buildings									
Cultural / Other Assets	●	●	●	●	●	●	●	●	●

Table 5-2 Management Zone 4 – River Heads – Vulnerable Assets

Asset Class	Present Climate (2019-2030)			2050 Future Climate			2100 Future Climate		
	Present HAT	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.3 m	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.8 m	1 in 100 Storm Tide	Erosion Prone Area
Land Zoning									
Community Facilities 2 (ha)	4.0	7.8	5.0	5.5	8.9	6.0	8.1	9.0	8.2
Emerging Communities (ha)	-	<0.1	<0.1	<0.1	0.3	0.1	0.2	0.4	0.3
Emerging Communities (parcel count)	-	1	1	1	1	1	1	1	1
Environmental Management & Conservation (ha)	914.1	1042.9	947.5	998.7	1117.1	1015.2	1097.4	1119.2	1105.7
Local Centre (ha)	-	-	-	-	-	<0.1	-	-	<0.1
Local Centre (parcel count)	-	-	-	-	-	1	-	-	1
Low Density Residential (ha)	0.6	3.2	1.6	1.1	8.4	3.6	3.1	9.8	8.1
Low Density Residential (parcel count)	6	16	22	11	31	47	17	35	54
Open Space (ha)	43.7	90.4	52.6	61.8	106.8	70.5	97.1	116.0	101.8
Rural (ha)	1531.4	2569.9	1689.1	2190.6	3036.4	2270.4	2781.6	3045.7	2801.3
Conservation and natural environments	-	*0.9*	-	-	*1.4*	-	-	*1.4*	-
Intensive uses	*22.5*	*44.0*	*23.2*	*36.9*	*52.7*	*39.0*	*47.6*	*53.6*	*50.1*
Sugar	-	*101.9*	*2.7*	*86.4*	*142.1*	*86.6*	*130.5*	*142.1*	*130.5*
Other irrigated agriculture and plantations	*16.7*	*133.8*	*46.7*	*70.6*	*175.3*	*79.1*	*138.8*	*175.3*	*138.8*
Grazing	*1178.8*	*1947.5*	*1271.4*	*1657.8*	*2300.5*	*1708.3*	*2117.0*	*2305.2*	*2123.9*
Wetlands, reservoirs and rivers	*313.5*	*341.8*	*345.0*	*338.9*	*364.4*	*357.4*	*347.6*	*368.1*	*357.9*
Rural Residential (ha)	5.5	38.2	10.5	11.3	45.6	15.8	38.5	46.6	41.6
Rural Residential (parcel count)	26	57	30	39	58	40	56	58	57

Management Zone 4 – River Heads

Asset Class	Present Climate (2019-2030)			2050 Future Climate			2100 Future Climate		
	Present HAT	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.3 m	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.8 m	1 in 100 Storm Tide	Erosion Prone Area
Matters of State Environmental Significance[5]									
Fish Habitat Areas (ha)	4181.7	4592.4	4581.5	4466.1	4815.4	4678.0	4720.6	4838.1	4785.2
High Ecological Significance (HES) Wetlands (ha)	3028.4	3574.4	3481.9	3401.6	3847.1	3641.5	3704.0	3936.1	3778.5
High Ecological Value (HEV) Waters-Watercourse (m length)	113670	121048	118985	119742	122903	122625	121950	123245	123096
High Ecological Value (HEV) Waters-Wetlands (ha)	3435.6	3880.9	3888.6	3749.2	4110.6	3987.4	4008.7	4137.7	4085.8
Regulated Vegetation, Category B Endangered or of Concern (ha)	522.9	778.9	584.6	687.3	929.4	710.2	847.0	962.3	860.2
Regulated Vegetation, Category C Endangered or of Concern (ha)	35.6	71.1	37.9	56.1	86.0	57.6	77.4	94.8	77.4
Regulated Vegetation, Category R GBR Riverine (ha)	139.6	154.2	154.2	154.2	154.2	154.2	154.2	154.2	154.2
Regulated Vegetation, Essential Habitat (ha)	2649.9	3215.1	3085.1	3027.2	3507.8	3259.2	3350.5	3598.3	3427.7
Regulated Vegetation, Intersecting a watercourse (m length)	68997	86606	79220	80241	92999	87043	89397	97249	91885
Wildlife Habitat, Threatened & Special Least Concern (ha)	4602.1	5160.5	5020.6	4976.4	5447.4	5203.2	5299.7	5532.7	5376.1
Beaches									
Ocean Beach (ha)	Nil								
Estuarine Beach (ha)	Entire Booral and River Heads Great Sandy Strait frontage								
Road Infrastructure									
Sealed Road – Main Road (m length)	-	36	84	-	140	220	-	258	220
Sealed Road – Main Road (m depth)	-	0.1	N/A	-	0.5	N/A	-	1.3	N/A

[5] Matters of State Environmental Significance includes wetland areas that may be outside of the local government boundary analysed, including tidal areas. The reported areas may also overlap.

Management Zone 4 – River Heads

Asset Class	Present Climate (2019-2030)			2050 Future Climate			2100 Future Climate		
	Present HAT	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.3 m	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.8 m	1 in 100 Storm Tide	Erosion Prone Area
Sealed Road (m length)		107	4	9	476	59	97	1436	374
Sealed Road (m depth)		0.9	N/A	0.2	1.7	N/A	0.7	2.4	N/A
Unsealed Road (m length)	638	2506	686	1399	3436	1405	2966	4688	3043
Unsealed Road (m depth)	0.6	1.1	N/A	0.9	1.9	N/A	1.4	2.6	N/A
Evacuation Route (m length)	-	41	105	-	140	219	-	255	219
Evacuation Route (m depth)	-	0.1	N/A	-	0.5	N/A	-	1.3	N/A
Sewerage									
Effluent Main (m length)	-	347	95	72	701	154	370	1211	370
Effluent Manhole, Meter, Value (count)	-	2	2	1	9	2	2	9	2
Effluent Reuse Facilities (count)	1	2	1	1	2	1	2	2	2
Stormwater Infrastructure									
Drains (m length)	166	213	188	185	250	201	213	498	242
Gross Pollutant Traps (count)	-	-	-	-	-	-	-	-	-
Pipes (m length)	31	231	55	132	828	196	269	1263	557
Pits (count)	10	26	14	16	42	23	29	62	39
Detention structures (count)	-	-	-	-	-	-	-	1	-
Water Supply Infrastructure									
AMR Logger (count)	-	1	-	-	5	1	2	20	3
Connections (m length)	-	43	-	-	108	3	38	247	42
Hydrants (count)	-	-	-	-	1	-	-	2	1
Mains (m length)	-	32	-	-	98	29	42	519	89
Meters (count)	-	1	-	-	3	1	2	18	3
Valves (count)	-	-	-	-	1	-	-	1	1

Management Zone 4 – River Heads

Asset Class	Present Climate (2019-2030)			2050 Future Climate			2100 Future Climate		
	Present HAT	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.3 m	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.8 m	1 in 100 Storm Tide	Erosion Prone Area
Other Infrastructure									
Other Electrical (count)	-	-	-	-	-	-	-	1	1
Fibre Optic Cable (m)	887	1956	914	1398	2857	1450	2308	4349	2308
Gas Mains (m length)	646	3109	1022	1414	4380	1783	3339	5513	3416
Other Assets									
Public Amenities	-	-	-	-	-	-	-	-	1
Tourist Info Centre River Heads (count)	-	-	-	-	-	-	-	-	1
Boat Ramps (count)	3	3	3	3	3	3	3	3	3
Heritage (count)	1	1	1	1	1	1	1	1	1
All Buildings (count)	9	25	12	13	51	22	25	114	45
Council Land (ha)	731.1	796.8	759.9	760.7	830.5	779.7	805.3	858.5	815.1

6 Management Zone 5 – Great Sandy Strait

This management zone incorporates the coastal settlements of Maaroom, Boonooroo, Tuan, Poona and Tinnanbar on the mainland shoreline of Great Sandy Strait, as well as the surrounding areas of Boonooroo Plains, The Dimonds, Tuan Forest and the Fraser Coast portion of Tin Can Bay (refer Figure 6-1). The Ramsar-listed Great Sandy Strait was formed by the proximity of the southern half of Fraser Island, and has been included in the assessment for Management Zone 7 (Fraser Island).

The management zone is dominated by vast expanses of protected areas, including Great Sandy Conservation Park, Tuan State Forest and Poona National Park.

The townships/settlements are embedded within these protected areas, and are each small fishing villages, Poona being the largest, with a mix of permanent residences and holiday houses. Each settlement supports recreational activities such as boating and fishing, with a formal boat ramp at all settlements. Caravan parks are located at Boonooroo, Poona and Maaroom and Tinnanbar. Poona and Boonoroo have small convenience stores.

Each settlement has small sandy beaches, which are connected along the shoreline by expansive areas of relatively untouched mangroves and salt pans.

6.1 General Hazard Impacts

The majority of impacts are associated with inundation via Great Sandy Strait and the local creek systems. Outside of the villages, which tend to be slightly more elevated, future erosion hazard extents are largely influenced by sea level rise.

At the villages, with the exception of Poona, dunes are largely non-existent. Landforms are very flat and generally low, with foreshore parkland/road reserves separating built assets from the beach. Vegetation in these areas has been selectively cleared for viewlines, but where intact, is able to respond naturally to hazard impacts. At Poona and Tinnanbar, this wide, undeveloped buffer plays an important role in limiting coastal hazard impacts on built development.

The locality of Tin Can Bay[6] includes large areas of land zoned as Limited Development (Constrained Land), which includes more than 500ha of land within the extent of present climate HAT.

Low and medium density residential land is impacted in each of the five villages, with Boonooroo the most affected village with nearly 5 ha of low density residential land within the 2050 HAT hazard extent and 15ha within the 2100 HAT hazard extent. Tinnanbar is the most elevated and therefore the least affected village, with less than 0.1ha within the 2100 erosion hazard extent.

Foreshore parkland in most of the villages is zoned as Open Space and is impacted by most, if not all coastal hazards, including present climate HAT.

Rural residential properties fringe some of the villages; at Boonooroo many of these properties adjoin the foreshore and are heavily impacted by all coastal hazards by 2100.

Rural land dominates the areas impacted by coastal hazards, with approximately half of all impacted rural land in the Management Zone contained within the locality of Tuan Forest, and a quarter within

[6] The locality known as Tin Can Bay covers parts of the Fraser Coast and Gympie local government areas. The town of Tin Can Bay is located within the Gympie local government area.

the Dimonds. The vast majority of the present and future climate impacted rural land is saline marsh or wetland, followed by areas used for conservation purposes. Whilst grazing land in The Dimonds is impacted by all coastal hazards by the 2100 future climate, large areas of native forest production in Tuan Forest are within all coastal hazard extents under all climates, except for present climate HAT.

6.2 Natural Areas and Matters of Environmental Significance

Large areas of land zoned as Environmental Management and Conservation are impacted by all hazards under all climates, including present climate HAT. These include extensive wetland areas around Boonooroo Plains, Maaroom and Tinnanbar. Impacts on these areas are expected to increase considerably by 2100, especially in Tinnanbar.

Much of these wetland areas are within the Ramsar site and are mapped as MSES, with very large expanses impacted by present climate HAT.

6.3 Council Infrastructure Assets

Nearly half of all Council roads impacted within this management zone are in Boonooroo. Eckert Road is affected by 2050 HAT, while by 2100 large parts of Schwarzrock Road, Davies Road and Rawson Street are also impacted. Substantial lengths of road throughout the locality are impacted by the 2050 and 2100 storm tide hazard extents.

Tuan Esplanade and Wilkinson Road at Tuan are also impacted under 2050 and 2100 storm tide and 2100 HAT. A section of Wilkinson Road is also affected by 2050 HAT though inundation depths are less than 0.1m. Roads close to foreshore areas such as Tuan Boat Ramp are affected by all coastal hazards by 2100.

Boonooroo Road and Tuan Road are also evacuation routes, however the assessed data layer does not correspond completely with the road data layer and discrepancies between the assessed impacts have been noted in the assessment table. Comparison with the road layer for these sections of roads indicates no impact other than in the vicinity of the Wilkinson Road and Boonooroo Road intersection.

At Poona, Boronia Drive is heavily impacted by 2100 HAT, while only minor impacts on local roads were identified at Tinnanbar.

Local roads close to the shoreline or wetland areas are within erosion hazard extents, particularly by 2100.

The Great Sandy Strait communities are unsewered and rely on tanks for water supply. Stormwater infrastructure impacts are largely confined to the seaward end of drainage lines within the various villages, with one stormwater detention structure in Boonooroo within all coastal hazard extents by the 2100 future climate.

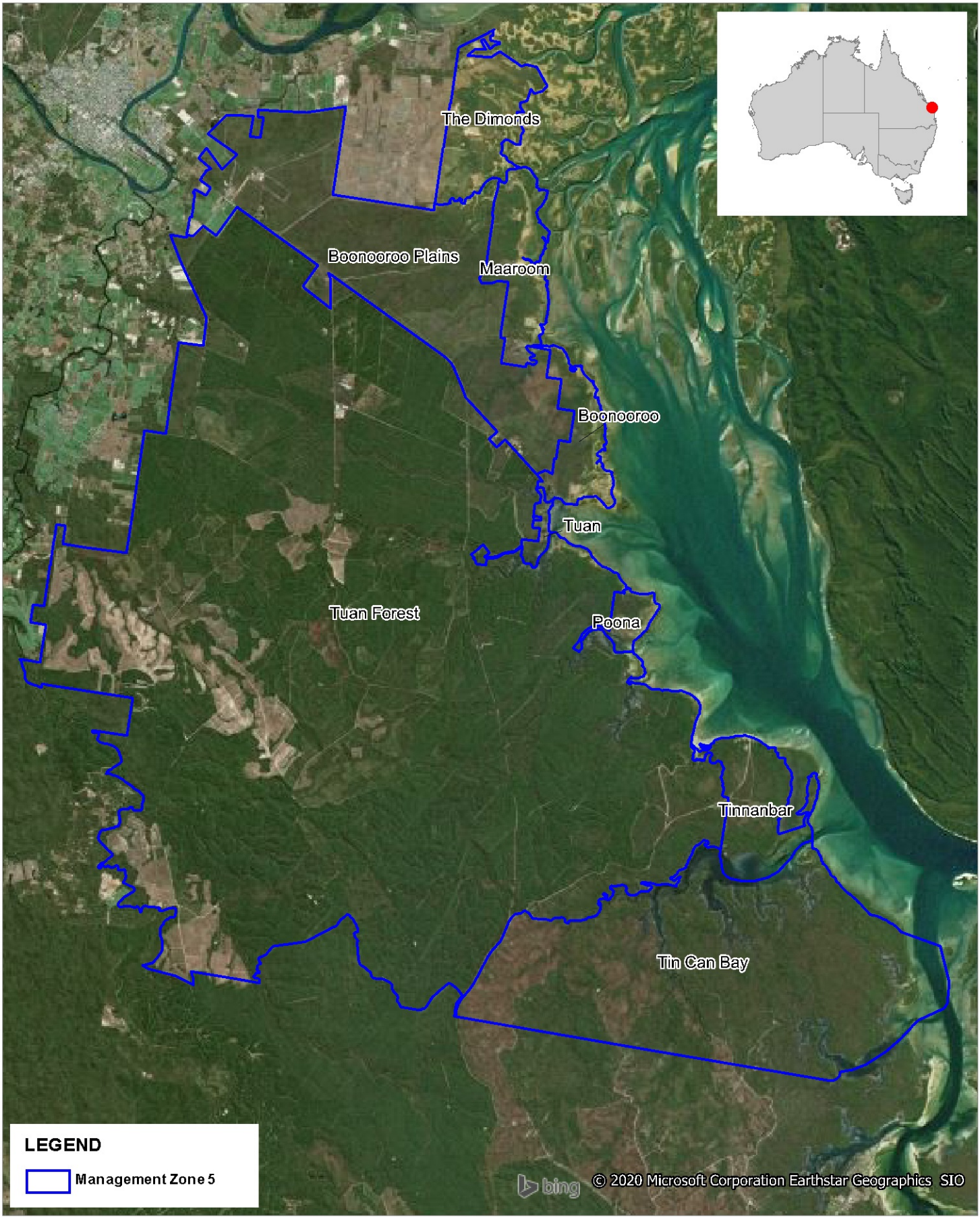
Boat ramps and ancillary structures such as floating walkways within each of the coastal villages are impacted by all coastal hazards under all climates.

6.4 Other Assets

Maryborough Cooloola Road is a State controlled road with a short section in Tuan Forest that is within the erosion hazard extents for all climates.

The Boonooroo Caravan Park is within all hazard extents for all climates and the Poona Palms Caravan Park is within all hazard extents for the 2100 future climate. Sandy Straits Coast Guard at Boonooroo is within the 2100 erosion hazard extent.

Building impacts are largely associated with the residential areas within each of the villages in the Management Zone. Buildings within the present climate HAT extent are all in The Dimonds, with the exception of one building at Boonooroo.



Title:

Fraser Coast CHAS Management Zone 5

Figure: 6-1

Rev: A

BMT WBM endeavours to ensure that the information provided in this map is correct at the time of publication. BMT WBM does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

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Table 6-1 Management Zone 5 – Great Sandy Strait – Hazard Overview

Asset Class	Present Climate (2019-2030)			2050 Future Climate			2100 Future Climate		
	Present HAT	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.3 m	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.8 m	1 in 100 Storm Tide	Erosion Prone Area
Natural Areas	●	●	●	●	●	●	●	●	●
Rural / Open Space / Recreation	●	●	●	●	●	●	●	●	●
Residential Areas	●	●	●	●	●	●	●	●	●
Industrial / Commercial									
Other Development	●	●	●	●	●	●	●	●	●
Matters of National Environmental Significance									
Matters of State Environmental Significance	●	●	●	●	●	●	●	●	●
Road Infrastructure	●	●	●	●	●	●	●	●	●
Sewerage									
Stormwater Infrastructure	●	●	●	●	●	●	●	●	●
Water Supply Infrastructure									
Council Buildings									
Cultural / Other Assets	●	●	●	●	●	●	●	●	●

Table 6-2 Management Zone 5 – Great Sandy Strait – Vulnerable Assets

Asset Class	Present Climate (2019-2030)			2050 Future Climate			2100 Future Climate		
	Present HAT	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.3 m	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.8 m	1 in 100 Storm Tide	Erosion Prone Area
Land Zoning									
Community Facilities 2 (ha)	0.2	0.2	0.3	0.2	0.4	0.4	0.5	0.6	0.6
Community Facilities 5 (ha)	-	-	-	-	<0.1	-	<0.1	<0.1	<0.1
Environmental Management & Conservation (ha)	766.4	1086.1	954.1	1101.7	1409.3	1182.8	1502.9	1542.1	1539.7
Limited Development (Constrained Land) (ha)	509.3	677.2	684.1	755.5	913.8	882.3	1117.6	1140.3	1168.9
Low Density Residential (ha)	1.9	4.5	5.1	7.1	21.5	10.5	32.3	33.6	33.7
Low Density Residential (parcel count)	22	82	74	132	268	190	355	374	386
Medium Density Residential (ha)	<0.1	<0.1	0.1	<0.1	0.7	0.3	1.3	1.3	1.3
Medium Density Residential (parcel count)	1	1	1	1	1	1	2	2	2
Open Space (ha)	7.3	12.5	14.7	13.8	19.2	19.0	23.3	24.1	24.8
Rural (ha)	960.5	1245.1	1225.1	1303.9	1669.5	1473.5	1911.4	1966.7	1990.7
Conservation and natural environments	*35.2*	*115.6*	*98.1*	*132.2*	*371.5*	*178.2*	*518.4*	*534.1*	*536.8*
Intensive uses	*4.0*	*10.5*	*9.2*	*11.7*	*31.4*	*16.7*	*41.7*	*43.5*	*43.5*
Cropping		*0.7*	*0.1*	*0.8*	*2.4*	*1.0*	*3.7*	*3.9*	*3.9*
Sugar					*1.8*	*0.0*	*9.2*	*9.2*	*9.2*
Grazing native vegetation			*1.3*	*0.0*	*0.0*	*2.1*	*4.9*	*11.7*	*11.1*
Production native forests		*84.6*	*144.6*	*123.0*	*210.5*	*220.5*	*277.0*	*296.5*	*318.4*
Marsh/wetland	*921.3*	*1033.7*	*971.9*	*1036.3*	*1051.9*	*1055.0*	*1056.5*	*1067.9*	*1067.9*
Rural Residential (ha)	0.3	1.4	1.5	2.0	6.5	3.0	10.4	11.3	11.2
Rural Residential (count)	11	20	18	22	34	26	40	40	40
Sport & Recreation (ha)	0.7	2.2	1.7	3.0	10.8	3.6	14.4	14.5	14.5

Management Zone 5 – Great Sandy Strait

Asset Class	Present Climate (2019-2030)			2050 Future Climate			2100 Future Climate		
	Present HAT	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.3 m	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.8 m	1 in 100 Storm Tide	Erosion Prone Area
Matters of State Environmental Significance[7]									
Fish Habitat Areas (ha)	4262.3	4290.6	4297.5	4310.5	4328.3	4319.9	4339.6	4344.9	4343.3
High Ecological Significance (HES) Wetlands (ha)	3790.8	4296.1	4236.0	4436.1	4930.1	4669.6	5281.1	5685.9	5408.7
High Ecological Value (HEV) Waters-Watercourse (m length)	37271	38273	38318	38461	39076	38809	39922	40267	40011
High Ecological Value (HEV) Waters-Wetlands (ha)	1717.6	1837.4	1814.9	1841	1918.7	1865.7	1939.2	1972.2	1951.1
Protected Area Estates (ha)	335.4	587.9	476.3	592.5	835.5	653.5	905.9	1056.6	948.2
Regulated Vegetation, Category B Endangered or of Concern (ha)	140.4	314.1	357.7	381.1	648.6	574.5	850.7	1080.4	1001.1
Regulated Vegetation, Category C Endangered or of Concern (ha)	0.8	3.8	2.3	3.9	21.6	4.8	24.4	27.7	24.7
Regulated Vegetation, Essential Habitat (ha)	4509.6	5165.3	5121.1	5346.5	5962.8	5699.0	6435.5	6962.9	6679.0
Regulated Vegetation, Intersecting a watercourse (m length)	67577	77077	86820	81518	87060	94026	96430	101041	98399
Wildlife Habitat, Threatened & Special Least Concern (ha)	5855.1	6368.5	6335.9	6530.7	7068.0	6842.8	7498.1	7970.9	7723.8
Beaches									
Ocean Beach (ha)	Nil								
Estuarine Beach (ha)	Entire Great Sandy Strait western frontage								
Road Infrastructure									
Sealed Road – Main Road (m length)	-	-	46	-	-	68	-	-	68
Sealed Road – Main Road (m depth)	-	-	N/A	-	-	N/A	-	-	N/A

[7] Matters of State Environmental Significance includes wetland areas that may be outside of the local government boundary analysed, including tidal areas. The reported areas may also overlap.

Management Zone 5 – Great Sandy Strait

Asset Class	Present Climate (2019-2030)			2050 Future Climate			2100 Future Climate		
	Present HAT	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.3 m	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.8 m	1 in 100 Storm Tide	Erosion Prone Area
Sealed Road (m length)		52	820	311	2176	1692	5210	9270	6750
Sealed Road (m depth)		0.2	N/A	0.2	0.5	N/A	0.7	1.1	N/A
Unsealed Road (m length)		182	247	246	1195	799	1677	2780	1836
Unsealed Road (m depth)		0.2	N/A	0.2	0.5	N/A	0.7	1.1	N/A
Evacuation Route (m length) [8]	97	240	601	250	349	791	429	575	954
Evacuation Route (m depth)	0.7	1.0	N/A	1.1	1.4	N/A	1.5	1.9	N/A
Stormwater Infrastructure									
Drains (m length)	461	1442	833	1665	2340	1776	3074	3438	3147
Gross Pollutant Traps (count)	-	-	-	-	-	-	1	1	1
Pipes (m length)	223	506	625	627	1456	1005	2398	3702	2587
Pits (count)	15	27	37	38	96	57	138	203	155
Detention structures (count)	-	-	-	-	-	-	1	1	1
Council Land									
Council Land (ha)	62.3	89.6	79.9	96	117.7	110.4	130.8	145	142.8
Other Infrastructure									
Electrical Other (count)	1	1	3	1	7	7	11	12	13
Other Assets									
Beach Access (count)	1	1	2	1	1	2	1	2	2
Boat Ramps (count)	8	8	8	8	8	8	8	8	8
Jetties and Piers (count)	2	2	2	2	2	2	2	2	2
Public Amenities (count)	-	-	-	-	2	3	2	2	4
Caravan Parks (count)	1	1	1	1	1	1	2	2	2

[8] Evacuation route mapping does not align with road footprint, inundation depths are overestimated.

Management Zone 5 – Great Sandy Strait

Asset Class	Present Climate (2019-2030)			2050 Future Climate			2100 Future Climate		
	Present HAT	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.3 m	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.8 m	1 in 100 Storm Tide	Erosion Prone Area
All Buildings (count)	6	32	52	57	221	135	365	564	447
Emergency Services (count)	-	-	-	-	-	-	-	-	1
Clubs (count)	-	-	-	-	1	-	1	1	1

7 Management Zone 6 – Mary River

This management zone incorporates all of the coastal hazard areas upstream of the mouth of the Mary River, starting from the localities of Beaver Rock and Tandora (refer Figure 7-1).

Set on the tidal reaches of the Mary River, Maryborough is a regional centre built on its rich heritage, traditional manufacturing and cane industries. Maryborough supports several regional government offices and various industries, with several significant heritage sites, the central business district and key public facilities located close to the River. Maryborough and the surrounding localities of Maryborough West, Granville and Tinana all contain low density housing and associated facilities and services, as well as rural areas. Growth areas at Granville have been identified within the current planning scheme.

The localities of Tandora, Beaver Rock, Prawle, Dundathu, Walliebum, Aldershot, Walkers Point, Island Plantation and St Helens surround the lower Mary River (and its tributaries) and are mainly rural areas, with pockets of rural residential, marine industries, open space and conservation areas.

Upstream of Maryborough, the Mary River localities of Tinana South, Bidwill, Oakhurst, Yengarie, Grahams Creek, Ferney, Mungar, Teddington, Owanyilla, Pioneer's Rest, Antigua and Glenorchy are predominantly rural.

7.1 General Hazard Impacts

Impacts within this management area are confined to the fringes of the Mary River and its tributaries, with erosion extents associated with estuarine channel migration. Mangrove and saline wetlands dominate the lower portions of the estuary.

As the Mary River has a long history of catchment flooding, most development is elevated and set back from the river banks. In places where the river channel is very well defined, inundation impacts from sea level rise and storm tide are largely confined within the existing river channel.

The riverfront fringe of numerous residential land parcels along the Mary River and its tributaries are within the present climate HAT extent. This includes low and medium density residential parcels lining the river at Tinana, Granville, and Maryborough, large areas of land zoned as Emerging Communities at Granville and along Saltwater Creek at St Helens, and rural residential parcels at Yengarie and Dundathu.

This also applies to the riverfront fringe of parcels zoned as High and Medium Impact Industry, such as the timber mill and industrial recycling facilities respectively in Maryborough, Maryborough Airport, which is zoned as Community Facilities 2, and the Brolga Theatre in Maryborough, zoned as Community Facilities 4. The hazard areas on these parcels do not contain any significant built infrastructure.

Coastal dependent land uses, including marine based industries such as boat repairs and premises within the Principal Centre, Low and Medium Impact Industry, Waterfront and Marine Industry and Sport and Recreation zones are impacted by all hazards under all climates.

By 2100, the erosion prone area hazard extent impacts on 183 buildings along the river, most of which are in Maryborough (59), Tinana (31), Beaver Rock (20) and Granville (18). Most of this impact

occurs after the 2050 future climate. Boat sheds associated with some properties have been identified as buildings below present climate HAT.

Close to Maryborough township low-lying land along the river already exposed to significant riverine flood impacts is zoned as Limited Development (Constrained Land). This area is generally undeveloped.

The remaining impacts are contained within the tidal riverfront fringes of land zoned as rural and open space. Rural land uses within hazard extents are dominated by grazing, with approximately half of all impacted land under all hazards and climates within the locality of Tandora, and major areas within Beaver Rock, Island Plantation and Prawle. Dundathu is also notably impacted under the 2100 storm tide. Land used for sugar is affected mainly within Island Plantation and Prawle under present climate and future hazards, with smaller impacts in most other localities by 2050 HAT. Future storm tide has particularly large impacts on sugar areas at Beaver Rock by 2050 and Walkers Point by 2100.

Upstream penetration of tidal inundation is presently limited by the presence of weirs, in particular Mary River Barrage (also known as Weir No 1). The effectiveness of this weir in continuing to limit tidal inundation is reduced over time due to sea level rise, with breaching of the weir from the 1 in 100 year ARI storm tide occurring under present climate conditions.

7.2 Natural Areas and Matters of Environmental Significance

As much of the area along the river has been cleared for rural uses, most areas within the hazard extents still in a largely natural state are confined to wetlands around the lower Mary River (i.e. within Beaver Rock, Walkers Point, Prawle and Tandora), much of which is within the extent of the present climate HAT. Impacts from storm tide are the most dominant due to the very flat and low-lying topography. No areas of National Environmental Significance are impacted. Under sea level rise scenarios, the extent of high ecological value waters (watercourse) impacted increases by more than 3 km by 2050, and more than 7 km by 2100 future climates.

7.3 Council Infrastructure Assets

Numerous extents of local roads are impacted by inundation, mostly by storm tide extents under 2050 and 2100 future climates. Areas where large sections of roads are impacted by 2050 HAT extents include Wharf Street (Maryborough), Island Plantation Road and Beaver Rock Road. These roads are also captured in erosion hazard extents.

Impacts on sewerage are dominated by inundation of effluent reuse infrastructure in Island Plantation under all hazards and climates. In this area the erosion prone area is governed by sea level rise extents. Other sewerage impacted services the residential and industrial development lining the riverfront in Maryborough, Tinana and Granville.

The river ends of stormwater assets in Tinana, Maryborough and Granville are impacted under all hazards and climates, however the expansive drainage network of pipes and open drains servicing the area between Kent and Alice Streets in Maryborough is directly impacted by sea level rise by 2050 and storm tide under present climate.

Water assets servicing Maryborough, Granville and Tinana are impacted by all hazards under all climates. Water mains are impacted under present climate HAT at crossings of the Mary River. No elevation data for the mains was available. Similar to sewerage, the remaining water infrastructure impacted services the residential and industrial development lining the riverfront.

Teddington Weir and the Mary River Barrage are impacted by all hazards over all climates. The fringes of the Teddington Water Treatment Plant site are within the 2100 storm tide hazard extent, however no infrastructure is affected.

The Aubinville Waste Treatment Plant is impacted by all hazards over all climates, however existing site infrastructure is only impacted under 2100 storm tide.

Fibre optic cable impacts occur under all hazards and climates at the crossing of Saltwater Creek.

The Queen's Park Council Depot site is within the 2050 and 2100 erosion prone area, although actual infrastructure may not be positioned within the hazard extent. This site also includes Council buildings that house the Maryborough Sailing Club (within the storm tide and erosion hazard extents from 2050 onwards) and the Maryborough Rowing Club (within the erosion hazard extent from 2050 onwards and the 2100 storm tide extent). The adjacent Brolga Theatre site is impacted by all hazards for all climates, with the deck and sculpture within the 2100 erosion hazard extent.

Public boat ramp facilities at Beaver Rock, Granville and Lamington are impacted by all coastal hazards under all climates, while the Yengarie boat ramp is within the erosion hazard extent for all climates.

7.4 Other Assets

Several State controlled roads are assessed as being impacted by coastal hazards. Roads associated with crossings of the Mary River, such as the Bruce Highway, Ferry Street, Gympie Road and Odessa Street are impacted by erosion hazards. Kent St at Maryborough is impacted by 2050 storm tide and Maryborough Hervey Bay Rd at Dundathu and Saltwater Creek Rd at St Helens are impacted by 2050 and 2100 storm tide. Some of these roads are also evacuation routes.

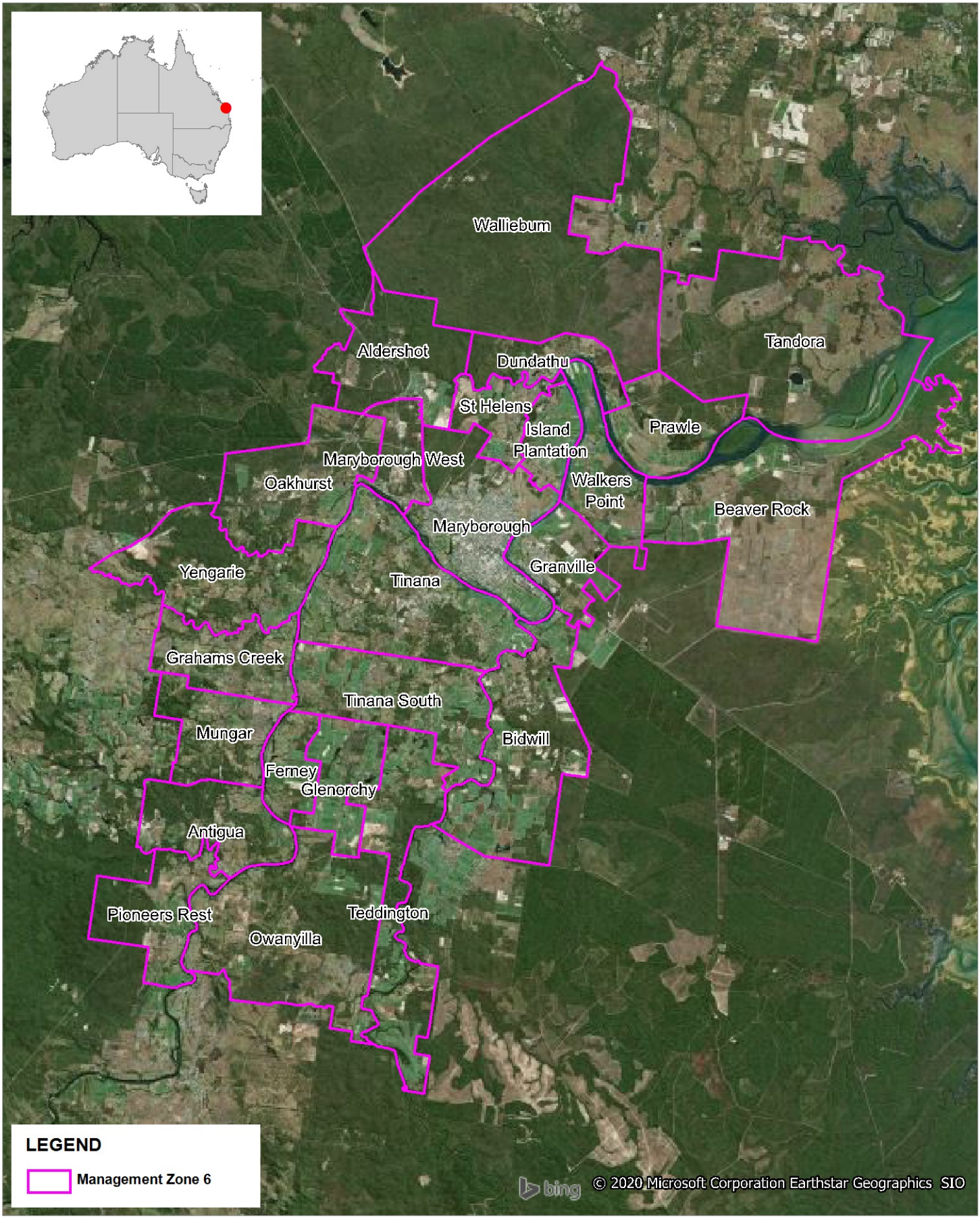
Gas mains are impacted at major waterway crossings such as at Gympie Road and Odessa Street (Mary River), Saltwater Creek Road (Saltwater Creek) and Maryborough Hervey Bay Road (Susan River). Similar to water mains, no elevation data for the gas mains was available.

The rail network is within the hazard extent in Maryborough around Queens Park and along the riverbank immediately upstream.

St Helens State School is within the 2100 storm tide hazard extent. Huntsville Caravan Park on the Mary River in Tinana is within all hazard extents for all climates. The Wallace Caravan Park i Maryborough is also impacted by all hazards for all climates, however actual development may not be positioned within the hazard extents.

There are numerous heritage sites within the coastal hazard extents. Sea level rise hazards impacting heritage sites under present climate HAT include Dundathu Training Walls, the former Walkers Shipbuilding Premises, George Furber's site, Lamington Bridge, Martha White's bush graves, Maryborough Wharf Branch, original Maryborough Town Site, Pettigrew & Sim Sawmill and Village, Wharf Timbers and Crane Base and the ruins of the Yengarie Sugar Refinery. Bidwill's Bridge at (Tinana) is impacted by the 2050 HAT. Additional sites exposed to present climate erosion hazards include Baddow House, Central Sugar Mill Ruins, Hynes Timber Mill, Ilfracombe, and the Pettigrew and Sim Sawmill and Village. Note that the location of the heritage items within affected sites is not always accurately recorded and therefore while part of the land parcel may be affected, the heritage values may or may not be impacted.

Buildings impacted by coastal hazards are largely those identified within the land zones bordering the river. These buildings include boathouses on Wharf Street Maryborough, and farm buildings at Beaver Rock and close to Saltwater Creek.



Title:

Fraser Coast CHAS Management Zone 6

Figure: 7-1

Rev: A

BMT WBM endeavours to ensure that the information provided in this map is correct at the time of publication. BMT WBM does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

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Table 7-1 Management Zone 6 – Mary River – Hazard Overview

Asset Class	Present Climate (2019-2030)			2050 Future Climate			2100 Future Climate		
	Present HAT	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.3 m	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.8 m	1 in 100 Storm Tide	Erosion Prone Area
Natural Areas	●	●	●	●	●	●	●	●	●
Rural / Open Space / Recreation	●	●	●	●	●	●	●	●	●
Residential Areas	●	●	●	●	●	●	●	●	●
Industrial / Commercial	●	●	●	●	●	●	●	●	●
Other Development	●	●	●	●	●	●	●	●	●
Matters of National Environmental Significance									
Matters of State Environmental Significance	●	●	●	●	●	●	●	●	●
Road Infrastructure	●	●	●	●	●	●	●	●	●
Sewerage	●	●	●	●	●	●	●	●	●
Stormwater Infrastructure	●	●	●	●	●	●	●	●	●
Water Supply Infrastructure	●	●	●	●	●	●	●	●	●
Council Buildings					●	●		●	●
Cultural / Other Assets	●	●	●	●	●	●	●	●	●

Table 7-2 Management Zone 6 – Mary River – Vulnerable Assets

Asset Class	Present Climate (2019-2030)			2050 Future Climate			2100 Future Climate		
	Present HAT	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.3 m	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.8 m	1 in 100 Storm Tide	Erosion Prone Area
Land Zoning									
Community Facilities 1 (ha)	<0.1	<0.1	0.1	<0.1	<0.1	0.2	<0.1	<0.1	0.2
Community Facilities 2 (ha)	1.0	4.2	3.6	2.5	6.6	5.2	5.4	7.0	5.9
Community Facilities 4 (ha)	<0.1	<0.1	0.1	<0.1	<0.1	0.2	<0.1	0.1	0.2
Emerging Communities (ha)	15.2	22.6	28.6	20.3	30.0	36.3	25.4	34.4	36.3
Emerging Communities (parcel count)	30	35	35	35	35	35	35	35	35
Environmental Management & Conservation (ha)	3.4	4.9	8.6	4.1	17.7	9.7	8.0	19.6	12.8
High Impact Industry (ha)	<0.1	<0.1	0.6	<0.1	0.1	1.4	<0.1	0.1	1.4
High Impact Industry (parcel count)	10	10	18	10	16	19	13	19	19
Limited Development (Constrained Land) (ha)	8.4	21.8	22.0	12.1	36.6	30.5	26.2	40.0	34.5
Low Density Residential (ha)	1.4	4.5	9.5	3.3	7.2	15.9	5.5	8.9	15.9
Low Density Residential (parcel count)	92	108	155	97	128	174	118	141	175
Low Impact Industry (ha)	3.0	4.3	4.1	3.8	5.5	5.2	5.2	5.8	5.8
Low Impact Industry (parcel count)	18	31	33	18	34	33	31	35	33
Medium Density Residential (ha)	<0.1	<0.1	0.2	<0.1	0.1	0.4	<0.1	0.1	0.4
Medium Density Residential (parcel count)	3	3	3	3	3	3	3	3	3
Medium Impact Industry (ha)	0.6	1.3	1.9	1.2	1.6	2.7	1.4	1.7	2.7
Medium Impact Industry (parcel count)	6	11	15	11	11	16	11	15	16
Open Space (ha)	7.1	9.9	15.2	8.7	16.1	20.2	13.8	20.8	22.5
Principal Centre (ha)	0.4	1.0	0.6	0.8	1.0	0.9	1.0	1.0	1.0
Principal Centre (parcel count)	5	7	5	7	7	7	7	7	7
Rural (ha)	1566.5	2570.4	2109.5	2212.5	3451.5	2614.4	3226.5	3551.9	3357.6

Management Zone 6 – Mary River

Asset Class	Present Climate (2019-2030)			2050 Future Climate			2100 Future Climate		
	Present HAT	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.3 m	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.8 m	1 in 100 Storm Tide	Erosion Prone Area
Conservation and natural environments	*64.6*	*201.6*	*147.6*	*219.1*	*363.6*	*249.9*	*428.5*	*465.3*	*434.7*
Intensive uses	*8.4*	*19.6*	*22.4*	*17.9*	*38.0*	*34.2*	*33.4*	*63.8*	*53.7*
Sugar	*299.4*	*522.1*	*480.5*	*487.6*	*839.1*	*599.5*	*899.6*	*1278.0*	*950.0*
Other cropping	*-*	*3.7*	*3.5*	*3.0*	*5.4*	*5.6*	*5.3*	*5.8*	*6.6*
Other irrigated agriculture and plantations	*-*	*-*	*-*	*-*	*0.4*	*0.5*	*0.3*	*1.1*	*3.8*
Grazing	*1150.2*	*1767.9*	*1397.7*	*1638.5*	*2539.8*	*1812.0*	*2536.4*	*3517.2*	*2643.5*
Wetlands, reservoirs and rivers	*43.9*	*55.5*	*57.8*	*54.5*	*76.4*	*73.2*	*75.3*	*97.9*	*88.7*
Rural Residential (ha)	1.7	5.6	8.7	2.9	9.8	14	7.4	13.1	17.2
Rural Residential (parcel count)	35	59	52	46	68	61	65	70	76
Sport & Recreation (ha)	0.1	0.2	0.2	0.1	0.4	0.4	0.3	0.4	0.5
Waterfront & Marine Industry (ha)	8.7	14.0	13.8	11.7	22.2	17.1	17.0	22.7	18.4
Matters of State Environmental Significance[9]									
High Ecological Significance (HES) Wetlands (ha)	1305.7	1490.2	1408.9	1447.7	1604.3	1494.9	1552.8	1755.0	1564.0
High Ecological Value (HEV) Waters-Watercourse (m)	52747	56638	54079	55896	59916	56570	58418	60180	58778
High Ecological Value (HEV) Waters-Wetlands (ha)	3279.3	3361.1	3322.8	3342.4	3408.0	3358.0	3380.0	3467.5	3382.8
Protected Area Estates (ha)	1.2	2.3	5.1	1.7	4.1	5.1	2.9	4.9	5.1
Protected Area Nature Refuges (ha)	43.7	51.8	46.7	49.0	55.4	50.9	53.3	86.3	53.3
Regulated Vegetation, Category B Endangered or of Concern (ha)	250.8	416.1	375.0	369.1	658.6	472.6	589.8	897.0	639.8
Regulated Vegetation, Category C Endangered or of Concern (ha)	2.9	6.8	8.4	6.0	18.8	12.6	18.4	36.0	21.9

[9] Matters of State Environmental Significance includes wetland areas that may be outside of the local government boundary analysed, including tidal areas. The reported areas may also overlap.

Management Zone 6 – Mary River

Asset Class	Present Climate (2019-2030)			2050 Future Climate			2100 Future Climate		
	Present HAT	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.3 m	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.8 m	1 in 100 Storm Tide	Erosion Prone Area
Regulated Vegetation, Category R GBR Riverine (ha)	173.6	208.7	208.7	208.7	208.7	208.7	208.7	208.7	208.7
Regulated Vegetation, Essential Habitat (ha)	1089.5	1380.4	1304.5	1298.5	1734.5	1472.5	1604.6	2230.5	1712.5
Regulated Vegetation, Intersecting a watercourse (m length)	90171	106813	104617	101797	132219	114840	115710	169260	118532
Wildlife Habitat, Threatened & Special Least Concern (ha)	1504.0	1781.0	1676.3	1706.2	2091.2	1833.6	1992.5	2438.3	2054.3
Beaches									
Ocean Beach (ha)	Nil								
Estuarine Beach (ha)	Minimal – Frontage of Mary River and tributaries								
Road Infrastructure									
Sealed Road – Main Road (m length)			739		111	1240		370	1240
Sealed Road – Main Road (m depth)	-	-	N/A	-	0.4	N/A	-	1.1	N/A
Sealed Road (m length)		612	728	294	2187	1330	1192	4491	1330
Sealed Road (m depth)		0.5	N/A	0.2	1.2	N/A	0.7	1.9	N/A
Unsealed Road (m length)	718	2600	1799	2001	7237	2550	4040	14739	4120
Unsealed Road (m depth)	0.7	1.3	N/A	1.0	2.1	N/A	1.5	2.8	N/A
Evacuation Route (m length)[10]			778		116	1092		518	1092
Evacuation Route (m depth)	-	-	N/A	-	0.4	N/A		1.1	N/A
Rail									
Rail network (m length)	-	311	208	207	846	722	557	1141	1023
Sewerage									
Waste Treatment Plant	1	1	1	1	1	1	1	1	1

[10] Evacuation route mapping does not align with road footprint, inundation depths may be overestimated.

Management Zone 6 – Mary River

Asset Class	Present Climate (2019-2030)			2050 Future Climate			2100 Future Climate		
	Present HAT	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.3 m	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.8 m	1 in 100 Storm Tide	Erosion Prone Area
Effluent Main (m length)	999	1589	2161	1327	2766	2453	1966	4335	2453
Effluent Manhole, Meter, Value (count)	14	23	29	21	45	32	29	62	32
Gravity Main (m length)	-	185	426	3	846	954	506	1579	954
Manhole, Valve (count)	-	3	6	-	14	16	7	23	16
House Connections (m length)	-	-	3	-	86	15	21	103	77
Pump Stations (count)	-	-	-	-	-	1	-	-	-
Stormwater Infrastructure									
Drains (m length)	108	1776	1643	541	2355	1674	1801	3360	1801
Pipes (m length)	70	702	708	317	1813	1160	1103	2480	1591
Pits (count)	13	50	45	36	128	73	76	191	98
Detention structures (count)	-	-	-	-	1	-	1	1	1
Water Supply Infrastructure									
Water Treatment Plant	-	-	-	-	-	-	-	1	-
AMR Logger (count)	5	12	11	10	21	14	14	34	19
Conduit (m length)	-	87	1	86	87	86	87	120	87
Connections (m length)	13	256	207	217	564	485	378	740	597
Hydrants (count)	1	3	2	2	8	3	5	13	8
Mains (m length)	547	924	1030	639	1366	1305	1099	2408	1369
Meters (count)	-	5	3	4	7	6	6	14	11
Miscellaneous Water Assets (count)	-	-	3	-	1	3	1	3	3
Valves (count)	1	3	4	2	9	6	6	22	17
Storage (count)	2	2	2	2	2	2	2	2	2

Management Zone 6 – Mary River

Asset Class	Present Climate (2019-2030)			2050 Future Climate			2100 Future Climate		
	Present HAT	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.3 m	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.8 m	1 in 100 Storm Tide	Erosion Prone Area
Other Infrastructure									
Fibre Optic Cable (m)	46	72	97	60	124	120	82	217	120
Electrical Other (count)	-	9	14	7	33	22	30	34	45
Gas Mains (m length)	471	635	766	562	888	980	709	1779	980
Other Assets									
Public Amenities (ha)	-	1	1	1	1	1	1	1	1
Council Land (ha)	21.3	34.1	44.6	28	67.9	57.4	46.6	100.5	61.8
Queens Park – sailing and rowing clubs (count)	-	-	-	-	1	2	-	2	2
Boat Ramps (count)	6	6	6	6	6	6	6	7	6
Jetties and Piers (count)	4	4	4	4	4	4	4	5	4
Caravan Parks (count)	2	2	2	2	2	2	2	2	2
Heritage (count)	10	11	16	11	14	17	13	18	17
All Buildings (count)	6	12	21	10	31	63	20	69	177
Clubs (count)	1	1	1	1	1	1	1	1	1
Schools (count)	-	-	-	-	-	-	-	1	-

8 Management Zone 7 – K'gari (Fraser Island) & Great Sandy Strait Islands

This management zone incorporates all of K'gari (Fraser Island), shown in Figure 8-1. Islands located within the Great Sandy Strait as also discussed in this section.

K'gari (Fraser Island) is a World Heritage Area approximately 123 kilometres in length and 22 kilometres at its widest point. With an area of 184,000 hectares, it is the largest sand island in the world.

The island supports a range of ecosystems including rainforest, sclerophyll forest, numerous freshwater lakes, coastal heathland (including wallum heaths) and sand dunes. Most of the island is contained within the Great Sandy National Park.

Development on the Island is clustered around the small villages of Dilli Village, Eurong, Happy Valley, Dundubara, Waddy Point, Orchid Beach and Kingfisher Bay. As there are few permanent residents (182 in the 2016 census), most of these villages largely cater for visitors to the Island.

K'gari (Fraser Island) ocean frontage is characterised by long, uninterrupted white sand beaches flanked by coloured sand cliffs. The immense parabolic dunes, sand blows and cliffs of coloured sands are part of the longest and most complete age sequence of coastal dune systems in the world and they are still evolving.

The dunes on the Hervey Bay frontage of the island are comparatively lower than those facing the Coral Sea and punctuated by small watercourses, but still back long sandy beaches. The shoreline is sandy and dominated by mangroves in the more southern and protected reaches of Great Sandy Strait.

The beach is an intrinsic part of the road network on K'gari (Fraser Island) due to the size of the dunes and to retain the landscape in its natural form, and Seventy-Five Mile Beach is the main southern vehicular access route fronting the Coral Sea from Inskip Point (Gympie Shire) to the Island's campgrounds and settlements.

Numerous islands are located within Great Sandy Strait, most of which are low-lying, mangrove fringed and uninhabited. A small number of these islands contain heritage sites of tourism interest or support built infrastructure such as holiday homes or residences. These include Stewart and Dream Islands. Along with parts of some of the K'gari (Fraser Island) villages, some of these developed islands are unzoned.

8.1 General Hazard Impacts

The primary hazard for the Coral Sea and northern Hervey Bay frontage is erosion, with the open coast shoreline exposed to erosion under present climate conditions. The large parabolic dunes backing the beaches are prone to slumping following erosion that undercuts the base of the slope. While the foreshore is undeveloped, the beach is a popular 4WD vehicle access route.

Storm tide impacts on this frontage are small and localised, largely due to the presence of the substantial and elevated dune system along the entire length of this sector.

On the Great Sandy Strait and southern Hervey Bay frontage of the island the low-lying landforms are more exposed to impacts from storm tide and sea level rise, particularly in the vicinity of the numerous small creek systems and around the low-lying islands within the Great Sandy Strait.

8.2 Natural Areas and Matters of Environmental Significance

Natural areas impacted by coastal hazards are associated with dune areas and bordering the extensive intertidal wetlands Dune areas are vulnerable to erosion over all climates. Inundation extents on the Coral Sea and northern Hervey Bay frontages are mainly contained within the existing beach area and are small compared to estuarine frontages. Impacted land is all part of the K'gari (Fraser Island) section of the Great Sandy National Park, within the boundary of the World Heritage Area / National Heritage Area and is zoned Environmental Management and Conservation.

Erosion of the coastal fringe along the Coral Sea frontage is likely to be sporadic and associated with storm events. The potential erosion hazard has been estimated at up to approximately 80 m under the present climate, ranging up to approximately 200 m by the 2100 planning period.

The beach width available for recreational and vehicular use is impacted by the various coastal hazards. The beach is expected to be unavailable immediately following major storm erosion where beach lowering or significant slumping of the dunes has occurred, and during periods of elevated water levels (e.g. storm tide events or higher tides).

This has major implications for general movement around the island and emergency beach access, given that the beach is the primary vehicular access route along much of the Island's ocean frontage.

As sea levels rise, the beach and foredunes would be expected to migrate landward into the currently more stable hind dune areas, which will maintain recreational beach width.

The waters of and low-lying landforms in Great Sandy Strait and adjoining K'gari (Fraser Island) are declared as Wetlands of International Importance under the Ramsar convention. While nearly 70,000 ha of wetlands are inundated under present climate HAT, approximately an additional 2300 ha is identified as being within the extent of the 2100 HAT. This area is also a declared Fish Habitat Area.

Large areas of wetlands and watercourses identified as having high ecological value or significance, supporting regulated vegetation or wildlife habitat are already within the present climate HAT extent. The fringes of these waterways are progressively impacted by coastal hazards under future climates.

8.3 Council Infrastructure Assets

Oldfield Rd at Eurong is the only sealed road impacted and is within the erosion prone area under all climates. Several unsealed roads (including sand tracks) are also impacted, particularly by erosion hazards with minor impacts from future storm tide (2050 and 2100). This is largely in the area of dune crossings at the seaward end of tracks as they approach the beach. Beach accesses are all sand tracks.

Council land on the Island mainly consists of local parks and drainage reserves in and around Eurong and Orchid Beach township areas, and a large parcel of land at the mouth of Figtree Creek.

8.4 Other Assets

There are several notable heritage sites within the hazard extents, however it must be noted that while the land parcel may be identified as being impacted, the position of the items of heritage significance within the land parcel are not identified and may not be directly impacted. The heritage sites on K'gari (Fraser Island) identified as being impacted comprise Bogimbah Reserve and Mission, historical sites at North White Cliffs, a protected area around the wreck of the SS Marloo on the beach near Orchid Beach, and the Sandy Cape Lightstation land parcel.

Within Great Sandy Strait Woody Island Lighthouses & Ancillary Building Site is also heritage listed.

Private infrastructure within villages is also within the hazard area, particularly at Kingfisher Bay Resort, where buildings are within storm tide and erosion hazard extents. The jetty/barge landing is within the extent of all coastal hazards under all climates. At Eurong, a number of buildings are within the erosion hazard zone under all climates, including the Fraser Island Police Station. Several dwellings on or near Stewart Island within the Great Sandy Strait are within all storm tide and erosion hazard extents.

A barge landing at Wanggoolba Creek is also impacted by all hazards under all climates.

Note that some areas on the island are not within Council's land use planning zones, including Kingfisher Bay Resort and an area at Wanggoolba Creek. These areas have been identified as being within a planning zone of "Other".

Title:

Fraser Coast CHAS Management Zone 7

Figure: 8-1

Rev: A

N

0 12.5 25km

Approx. Scale

BMT

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Table 8-1 Management Zone 7 – K'gari (Fraser Island) & Great Sandy Strait Islands – Hazard Overview

Asset Class	Present Climate (2019-2030)			2050 Future Climate			2100 Future Climate		
	Present HAT	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.3 m	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.8 m	1 in 100 Storm Tide	Erosion Prone Area
Natural Areas	●	●	●	●	●	●	●	●	●
Rural / Open Space / Recreation			●			●			●
Residential Areas	●	●	●	●	●	●	●	●	●
Industrial / Commercial									
Other Development	●	●	●	●	●	●	●	●	●
Matters of National Environmental Significance	●	●	●	●	●	●	●	●	●
Matters of State Environmental Significance	●	●	●	●	●	●	●	●	●
Road Infrastructure			●		●	●		●	●
Sewerage									
Stormwater Infrastructure									
Water Supply Infrastructure									
Council Buildings									
Cultural / Other Assets	●	●	●	●	●	●	●	●	●

Table 8-2 Management Zone 7 – K'gari (Fraser Island) & Great Sandy Strait Islands – Vulnerable Assets

Asset Class	Present Climate (2019-2030)			2050 Future Climate			2100 Future Climate		
	Present HAT	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.3 m	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.8 m	1 in 100 Storm Tide	Erosion Prone Area
Land Zoning									
Community Facilities 2 (ha)	0.1	0.7	0.7	0.3	1.8	1.0	1.0	2.0	1.6
Community Facilities 4 (ha)	-	-	1.6	-	<0.1	1.9	-	<0.1	1.9
Environmental Management & Conservation (ha)	6307.2	8022.9	9409.6	7337	8744.6	10602.7	8407.8	9247.6	11503.9
Low Density Residential (ha)	<0.1	<0.1	1.2	0.1	0.9	2.3	1.6	1.6	3.4
Low Density Residential (parcel count)	1	3	37	5	10	47	12	14	48
Mixed Use (ha)	0.5	0.5	2.7	0.5	0.5	3.0	0.5	1.9	3.0
Open Space (ha)	-	-	0	-	-	0.1	-	-	0.1
Rural (ha)	-	-	0.3	-	-	0.7	-	-	0.7
Conservation and natural environments	-	-	*0.3*	-	-	*0.7*	-	-	*0.7*
Other (ha)	25.1	28.2	30.3	26.4	29.4	31.2	27.9	29.6	31.9
Other (parcel count)	3	5	4	3	6	5	4	7	5
Matters of National Environmental Significance									
Wetlands of International Importance (Ramsar) (ha)	69649.9	70981.2	70882.6	70822.5	71635.3	71382.0	71648.4	72053.6	71900.2
World /National Heritage Properties (ha)	19160.1	21275.6	22812.3	20176.4	22423.5	23966.8	21420.2	23898.0	25486.5
Matters of State Environmental Significance[11]									
Fish Habitat Areas (ha)	22488.1	23261.3	23115.2	23225	23653.7	23406.3	23681.7	23838.7	23742.7
High Ecological Significance (HES) Wetlands (ha)	10484.2	12149.0	11345.4	11760.2	12969.3	12129.8	12648.6	13836.4	12897.7
High Ecological Value (HEV) Waters-Watercourse (m)	234630	249087	250591	243155	259533	259239	250266	274032	266501
High Ecological Value (HEV) Waters-Wetlands (ha)	64979.8	66654.7	66107.3	66244.9	67455.0	66874.6	67058.4	68233.6	67552.8

[11] Matters of State Environmental Significance includes wetland areas that may be outside of the local government boundary analysed, including tidal areas. The reported areas may also overlap.

Management Zone 7 – K'gari (Fraser Island) & Great Sandy Strait Islands

Asset Class	Present Climate (2019-2030)			2050 Future Climate			2100 Future Climate		
	Present HAT	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.3 m	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.8 m	1 in 100 Storm Tide	Erosion Prone Area
Protected Area Estates (ha)	3318.9	4723.4	6190.3	4101.3	5754.4	7271.9	5007.3	7127.1	8753.5
Regulated Vegetation, Category B Endangered or of Concern (ha)	226.5	533.2	614.9	479.5	701.9	861.1	649.1	877.7	1111.8
Regulated Vegetation, Essential Habitat (ha)	4671.6	6129.8	6636.5	5629.5	7212.9	7690.4	6692.3	8439.4	9111.2
Regulated Vegetation, Intersecting a watercourse (m)	55482	66145	68898	60392	71579	75166	65637	78790	82081
Strategic Environmental Area Designated Precinct (ha)	3329.9	4295.7	4022.2	3852.7	4943.2	4441.1	4437.4	5641.9	5010.8
Wildlife Habitat, Threatened & Special Least Concern (ha)	3271.6	4386.3	4683.9	3978.6	5190.2	5480.7	4744.5	6193.7	6502.6
Beaches									
Ocean Beach (ha)	Entire Coral Sea & Hervey Bay frontage								
Estuarine Beach (ha)	Entire Great Sandy Strait frontage								
Road Infrastructure									
Sealed Road (m length)	-	-	77	-	-	98	-	-	133
Sealed Road (m depth)	-	-	N/A	-	-	N/A	-	-	N/A
Unsealed Road (m length)	-	-	435	-	14	540	-	30	786
Unsealed Road (m depth)	-	-	N/A	-	0.5	N/A	-	1.4	N/A
Other Assets									
Council Land (ha)	7.4	8.4	11.1	8.6	10.1	12.4	10.8	13.0	13.3
Barge Landings (count)	2	2	2	2	2	2	2	2	2
Heritage (count)	4	5	5	4	5	5	5	5	5
Buildings (count)	2	6	156	6	83	179	20	111	234
Emergency Services (count)	-	-	1	-	-	1	-	-	1

9 Prioritisation of Assets

The prioritisation of critical assets and infrastructure is vital to support the coastal hazard risk assessment to be undertaken in Phase 5 of the CHAS. As a risk assessment of individual assets is not practical on a local government-wide scale, the CHAS needs to focus on key assets or groups of assets at a reasonable scale. For the Fraser Coast Regional Council area, it is suggested that assets be grouped and assessed at a community/village level.

While recognising that local government has a responsibility to provide services to the community in accordance with their responsibilities under the *Local Government Act 2009*, high priority assets have been defined as those that meet one or more of the following criteria:

- Critical assets, which are defined as assets used:
  - during emergency events e.g. shelters, SES headquarters, ambulance, police, fire stations, marine rescue, critical roads, airports, ports, hospital, electricity sub-stations, STP etc.
  - to mitigate the impacts of coastal hazards on high value infrastructure, such as seawalls
  - by vulnerable people e.g. schools, child care, aged care accommodation, correctional facility
  - to store valuable items, important documents or historical records e.g. museums, art gallery, library, archive storage etc.
- Assets with high community or cultural value e.g. swimming pools, heavy-use parks and beaches, showgrounds, botanic gardens etc.
- Assets with a replacement cost of more than $500,000[12]
- Assets with a high economic value e.g. tourist infrastructure, business centres
- Areas of high conservation importance, which are defined as:
  - World Heritage Areas
  - National Parks
  - Conservation Reserves
  - Known nesting or breeding areas for conservation species (i.e. endangered, vulnerable or of concern)
  - State heritage sites

All identified assets/asset groups have therefore been prioritised according to:

- Difficulty to replace an asset
- The cost of replacing an asset
- The value the community places on an asset
- The scarcity of an asset across the local government area

[12] The 2019/20 Reconstruction of Essential Public Assets (REPA) relief measures trigger point for Fraser Coast Regional Council is $530,265.

- The remaining design life of an asset i.e. a shorter design life may create opportunities for asset replacement or responding to a changing risk profile easier
- The ability of an asset to withstand a hazard
- The criticality of an asset i.e. is an essential service in an emergency
- Biodiversity value
- The role the asset plays in Fraser Coast's economy i.e. fiscal contribution
- The aesthetic value of an asset.

This prioritisation process used the framework shown in Table 9-1 to identify how well an asset satisfied each criterion. Any assets that received a score greater than 4 (on a scale of 1 to 5) against any of the criteria were identified as priority assets for inclusion in the risk assessment.

Table 9-1 Asset Prioritisation Criteria

Criteria/Score	1	2	3	4	5
Difficulty to replace an asset	Very Easy	Easy	Average	Difficult	Very Difficult
The cost of replacing an asset	Very Inexpensive	Inexpensive	Average	Expensive	Very Expensive
The value the community places on an asset	Negligible	Low	Average	High	Very High
The scarcity of an asset across the region	Very Common	Common	Average	Rare	Very Rare
The remaining design life of an asset	Up to 5 years	Up to 10 years	Up to 25 years	Up to 50 years	More than 50 years
The ability of an asset to withstand a hazard	Very Good	Good	Average	Poor	Very Poor
The criticality of an asset i.e. is an essential service in an emergency	Negligible	Low	Average	High	Very High
Biodiversity value	Negligible	Low	Average	High	Very High
The role the asset plays in Fraser Coast's economy i.e. fiscal contribution	Negligible	Unimportant	Average	Important	Very Important
The aesthetic value of an asset	Negligible	Low	Average	High	Very High

Valuation data was available for selected assets. A summary of tangible asset values for key built assets is provided in Table 9-2. These values represent replacement costs of assets within each hazard extent. Valuation data was not available for all assets, including non-Council owned infrastructure such as Urangan Boat Harbour, State controlled roads, and community/sporting clubs.

Table 9-2 Tangible Asset Values for Selected Assets

Asset Class	Present Climate (2019- 2030)			2050 Future Climate			2100 Future Climate		
	Present HAT	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.3 m	1 in 100 Storm Tide	Erosion Prone Area	Present HAT + 0.8 m	1 in 100 Storm Tide	Erosion Prone Area
Existing Residential Areas	$5.3m	$582m	$348m	$102m	$2.2b	$534m	$482m	$5.0b	$1.2b
Council Road Infrastructure	$7.1m	$35.5m	$18.1m	$17.1m	$92.2m	$34.5m	$29.4m	$159.2m	$60.6m
Sewerage	$4.7m	$19.0m	$12.5m	$6.0m	$47.6m	$17.6m	$16.9m	$94.8m	$36.2m
Stormwater Infrastructure	$15.0m	$50.7m	$25.8m	$28.4m	$96.4m	$40.0m	$47.0m	$141.4m	$58.5m
Water Supply Infrastructure	$0.7m	$10.8m	$17.8m	$1.5m	$25.8m	$19.6m	$3.7m	$69.8m	$29.4m
Council Electrical Assets	$0.1m	$0.8m	$1.2m	$0.2m	$1.8m	$2.1m	$0.7m	$2.5m	$2.6m
Council Land	$0.1m	$2.2m	$0.3m	$0.9m	$6.5m	$2.4m	$1.8m	$6.9m	$4.2m
Council Coastal Assets	$11.7m	$24.1m	$29.6m	$12.8m	$27.1m	$29.6m	$17.3m	$29.8m	$29.6m
Other Council Assets	$0.3m	$7.6m	$10.8m	$0.7m	$14.8m	$15.4m	$4.0m	$19.6m	$19.2m

Council holds property valuation data on all land parcels within the local government area, however this data was not made available for the purposes of this reporting. Values for residential areas were based on typical real estate values in impacted areas and includes typical housing costs.

Some of these assets are also considered to have intangible values, i.e. it is difficult to place a monetary value on beaches or areas of conservation significance, as opposed to the tangible or known value of a piece of built infrastructure. An understanding of the value of intangible assets to the local community was gathered through engagement activities and from similar studies around Australia. This information has informed the assessment against the asset prioritisation criteria.

While exact monetary values are not required at this stage of the CHAS process, the prioritisation criteria uses the gathered information to provide an indication of the relative value of the assets (e.g. high, medium or low). Valuation data will be applied further in Phase 7 of the CHAS.

A list of high priority assets impacted by coastal hazards has been developed based on the criteria list and is summarised in Table 9-3 using the most common criteria as many assets satisfy more than one criterion. Assets identified as having an affected pipe or road length of more than 50 m are included on the basis that they have a substantial replacement cost. Note that the actual consequence of any impacts from coastal hazards will be considered as part of Phase 5 of the CHAS.

Not all of these assets are owned or managed by FCRC, and the asset prioritisation process also supports ongoing identification of key stakeholders for involvement in adaptation planning.

Table 9-3 Summary of High Priority Assets

Asset	Hazard			Primary Criteria				
	Erosion	Storm Tide	Sea Level Rise	Critical	Community	Cost	Economic	Natural Environment
Impacted assets present in multiple localities								
Open Coast Dune System and Beaches	Present	Present	Present		★		★	★
Estuarine Shores	Present	Present	Present					★
Beach Access	Varies	Varies	Varies		★			
Coastal Protection Structures	Present	Present	Present	★	★	★		
Boating Facilities	Present	Present	Present		★		★	
All natural areas (Environmental Management & Conservation zone throughout the Region, includes National Parks)	Present	Present	Present					★
Management Zone 1 – Burrum Heads								
Residential areas	Present	Present	Present		★	★		
Future residential (Emerging Communities)	Present	Present	Present		★	★		
Commercial areas		Present			★		★	
Sewerage	Present	Present	Present	★		★		
Stormwater Infrastructure	Present	Present	Present	★		★		

Asset	Hazard			Primary Criteria				
	Erosion	Storm Tide	Sea Level Rise	Critical	Community	Cost	Economic	Natural Environment
Water Supply Infrastructure	Present	Present	Present	★		★		
Local Roads	Present	Present	Present	★	★	★		
Burrum Heads Rd[13]	Present	Present	2100	★	★	★	★	
Pialba Burrum Heads Rd[13]	Present	2100		★	★	★	★	
Burrum Heads Sewage Treatment Plant		2100		★		★		
Railway	2050			★	★	★	★	
Gas Mains	2100	Present	2100	★	★	★		
Caravan Parks	2050	2050			★		★	
Emergency Services		Present		★				
Burrum Heads Library	2100	Present	2100		★	★		
Council Parkland/Reserves	Present	Present	Present		★			★
Burrum Coast National Park	Present	Present	Present					★
Management Zone 2 – Toogoom to Dundowran Beach								
Residential areas	Present	Present	Present		★	★		
Future residential (Emerging Communities)	Present	Present	Present		★	★		
Commercial areas	Present	Present	2050		★		★	
Sewerage	Present	Present		★		★		
Stormwater Infrastructure	Present	Present	Present	★		★		
Water Supply Infrastructure	Present	Present	Present	★		★		
Local Roads	Present	Present	Present	★	★	★		
Pialba Burrum Heads Rd[13]	Present	Present	Present	★	★	★	★	
Gas Mains	2100	Present	2100					
Caravan Parks	Present	2100			★		★	
Emergency Services	2100	2050		★				
Jetty	Present	Present	Present		★		★	
Council Parkland/Reserves	Present	Present	Present		★			★
Beelbi Creek and O'Regan Creek Conservation Park	Present	Present	Present					★
Management Zone 3 – Eli Waters to Urangan								
Residential areas	Present	Present	Present		★	★		
Future residential (Emerging Communities)	Present	Present	Present		★	★		
Commercial areas	2050	Present	2050		★		★	

[13] Also an evacuation route

Asset	Hazard			Primary Criteria				
	Erosion	Storm Tide	Sea Level Rise	Critical	Community	Cost	Economic	Natural Environment
Sewerage	Present	Present	Present	★		★		
Stormwater Infrastructure	Present	Present	Present	★		★		
Water Supply Infrastructure	Present	Present	Present	★		★		
Local Roads	Present	Present	Present	★	★	★		
Pialba Burrum Heads Rd		2100		★	★	★	★	
Gas Mains	Present	Present	2100					
Urangan Boat Harbour	Present	Present	Present	★	★	★	★	
Wetside Water Education Park	Present	2100			★	★	★	
Seafront Oval	Present	Present	2100		★			
Hervey Bay Historical Museum	Present	Present	2100		★			
Caravan Parks	Present	2050			★		★	
Emergency Services	2050	2100		★				
Jetties	Present	Present	Present		★	★	★	
Council Parkland/Reserves	Present	Present	Present		★			★
Management Zone 4 – River Heads								
Residential areas	Present	Present	Present		★	★		
Future residential (Emerging Communities)	Present	Present	2050		★	★		
Commercial areas	2050				★		★	
Sewerage	Present	Present	Present	★		★		
Stormwater Infrastructure	Present	Present	Present	★		★		
Water Supply Infrastructure	2050	Present	2100	★		★		
Local Roads	Present	Present	Present	★	★	★		
Maryborough Hervey Bay Rd[13]	Present	2100		★	★	★	★	
Booral Rd[13]	2050	Present		★	★	★	★	
Gas Mains	Present	Present	Present					
River Heads Tourist Information Centre	2100				★			
Barge Landings	Present	Present	Present	★	★	★	★	
Booral Homestead Complex	Present	Present	Present		★	★		
Council Parkland/Reserves	Present	Present	Present		★			★
Management Zone 5 – Great Sandy Strait								
Residential areas	Present	Present	Present		★	★		
Stormwater Infrastructure	Present	Present	Present	★		★		
Local Roads	Present	Present	2050	★	★	★		

Asset	Hazard			Primary Criteria				
	Erosion	Storm Tide	Sea Level Rise	Critical	Community	Cost	Economic	Natural Environment
Maryborough Cooloola Rd[13]	Present			★	★	★		
Boonooroo/Wilkinson Rd[13]	Present	2100		★	★			
Caravan Parks	2100	2050	2100		★		★	
Emergency Services	2100			★				
Jetties/Pontoons	Present	Present	Present		★	★	★	
Council Parkland/Reserves	Present	Present	Present		★			★
Great Sandy Strait Ramsar Wetlands	Present	Present	Present					★
Management Zone 6 – Mary River								
Residential areas	Present	Present	Present		★	★		
Future residential (Emerging Communities)	Present	Present	Present		★	★		
Commercial areas	Present	Present	Present		★		★	
Industrial areas	Present	Present	Present		★		★	
Sewerage	Present	Present	Present	★		★		
Stormwater Infrastructure	Present	Present	Present	★		★		
Water Supply Infrastructure	Present	Present	Present	★		★		
Local Roads	Present	Present	Present	★	★	★		
Numerous State Controlled Roads around Maryborough[13]	Present	2050		★	★	★	★	
Railway	Present	Present	2050	★	★	★	★	
Gas Mains	2100	Present	2100	★	★	★		
Caravan Parks	2100				★		★	
Jetties	Present	Present	Present		★	★	★	
Community sporting clubs	2050	2050	2100		★	★		
Various Heritage Sites	Present	Present	Present		★		★	
Council Parkland/Reserves	Present	Present	Present		★			★
Management Zone 7 – K'gari (Fraser Island) and Great Sandy Strait Islands								
Residential areas	Present	Present	Present		★	★		
Tourism areas	Present	Present	Present		★		★	
Local Roads	Present	2050		★	★	★		
Various Heritage Sites	Present	Present	Present		★		★	
Emergency Services	Present			★	★			
Barge Landings	Present	Present	Present	★	★	★	★	
K'gari (Fraser Island) World Heritage Area	Present	Present	Present		★		★	★

10 References

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DEHP (2016). Developing a Coastal Hazard Adaptation Strategy: QCoast$_{2100}$ Minimum Standards and Guideline for Queensland Local Governments. Prepared by: The Local Government Association of Queensland and The Department of Environment and Heritage Protection, State of Queensland, Oct, 68 pp.

Appendix A Digital Data Summary

Table A-1 Summary of assessed GIS Asset Data Layers supplied by Council

Asset layers supplied by Council	Use
Transport/Road assets	
BridgesCulverts	Used to provide asset $ value only
CarParkHardstand	Used to provide asset $ value only
FCMDRoads	Used to assess impacted assets only
EvacuationRoutes	Used to assess impacted assets only
FootPath	Used to provide asset $ value only
KerbsIslandsChannel	Used to provide asset $ value only
RailNetwork	Used to assess impacted assets only
Roads	Used to provide asset $ value only
Water supply assets	
Dams_Weirs	Used to assess impacted assets only
Site Assets[14]	Used to identify impacted assets and to provide asset $ value
Water AMR	Used to identify impacted assets and to provide asset $ value
Water Connections (point layer)	Used to provide asset $ value only
WaterConduit	Used to assess impacted assets only
WaterConnections (polyline)	Used to assess impacted assets only
WaterFillStations	Used to assess impacted assets only
WaterHydrants	Used to assess impacted assets only
WaterMains	Used to assess impacted assets only
Water Mains and Fittings	Used for number of assets and $ value
WaterRTUs	Used to assess impacted assets only
WaterStorage	Used to assess impacted assets only
WaterTanks	Used to assess impacted assets only
WaterValves	Used to assess impacted assets only
Stormwater assets	
FCMDOpenDrainChannels	Used to provide asset $ value only
FCMDStormwaterPipes	Used to assess impacted assets only
SWdetentionStructures	Used to identify impacted assets and to provide asset $ value
SWGrossPollutantTraps	Used to identify impacted assets and to provide asset $ value
SWPipes	Used to provide asset $ value only
SWPits	Used to identify impacted assets and to provide asset $ value
Sewer assets	
Effluent Reuse	Used to provide asset $ value only
SewerEffluentMain	Used to assess impacted assets only
SewerGravityMains	Used to assess impacted assets only

[14] Water and sewerage assets

Asset layers supplied by Council	Use
Sewer Gravity Mains, Manholes, Valves	Used to assess impacted assets (Manholes and Valves only) and to provide asset $ value (Gravity Mains, Manholes and Valves)
Sewer House Connections	Used to assess impacted assets only
Coastal assets	
CoastalFinal[15]	Used to identify impacted assets (except seawalls) and to provide asset $ value
FCMDSeawalls	Used to assess impacted assets only
Gas assets	
GasMains	Used to assess impacted assets only
QldGasMainLines	Used to assess impacted assets only
Electrical/Telecommunications assets	
Electrical	Used to provide asset $ value only
FCTelecommunicationsCable	Used to assess impacted assets only
OpticFibreCable	Used to assess impacted assets only
WBWFibreOpticCable	Used to assess impacted assets only
Buildings/Land assets	
CouncilLand	Used to assess impacted assets only
DCDB	Used to assess impacted assets only
GEOVISIONBuildingOutlines2018	Used to assess impacted assets only
Land	Used to provide asset $ value only
Other assets	
BuildingsFinal[16]	Used to assess impacted assets and to provide asset $ value
CommunityFacilities	Used to assess impacted assets only
CouncilFacilities	Used to assess impacted assets only
FCPSHeritageRegisterInventory	Used to assess impacted assets only
OtherStructures[17]	Used to provide asset $ value only
ParkStructures	Used to provide asset $ value only
PlaygroundEquip	Used to provide asset $ value only

[15] Includes miscellaneous coastal use assets – beach access structures, boat ramps, jetties/piers etc.
[16] Includes public amenities, aged care accommodation, Queens Park Depot.
[17] Miscellaneous assets – fences, memorials, signs, bollards, etc.

Table A-2 Summary of assessed State GIS Asset Data Layers

State Layers	Use
MSES_Protected_area_nature_refuges	Used to assess impacted assets only
MSES_RV_category_B_endangered_or_of_concern	Used to assess impacted assets only
MSES_RV_category_C_endangered_or_of_concern	Used to assess impacted assets only
MSES_RV_category_R_GBR_riverine	Used to assess impacted assets only
MSES_RV_essential_habitat	Used to assess impacted assets only
MSES_RV_intersecting_a_watercourse	Used to assess impacted assets only
MSES_Strategic_environmental_area_designated_precinct	Used to assess impacted assets only
MSES_Wildlife_habitat_threatened_and_special_least_concern_animal	Used to assess impacted assets only
Ramsar	Used to assess impacted assets only
WorldHeritage	Used to assess impacted assets only

BMT has a proven record in addressing today's engineering and environmental issues.

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