AQUIS RESORT AT THE GREAT BARRIER REEF PTY LTD

# ENVIRONMENTAL IMPACT STATEMENT

## VOLUME 1

## CHAPTER 3

# SITE DESCRIPTION

# 3. SITE DESCRIPTION

## 3.1 LOCATION AND CONTEXT

The Aquis Resort is proposed for a site which is located to the south of the residential community of Yorkeys Knob approximately 13 km north of the Cairns CBD and 6 km north of Cairns International Airport as shown on **Figure 3-1** and **Figure 3-2** below.

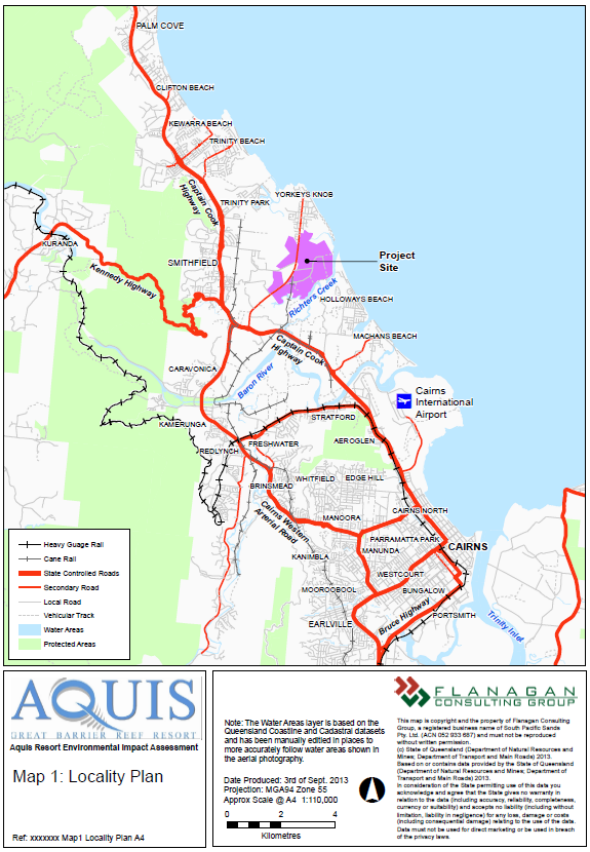


**Figure 3-1** Locality plan

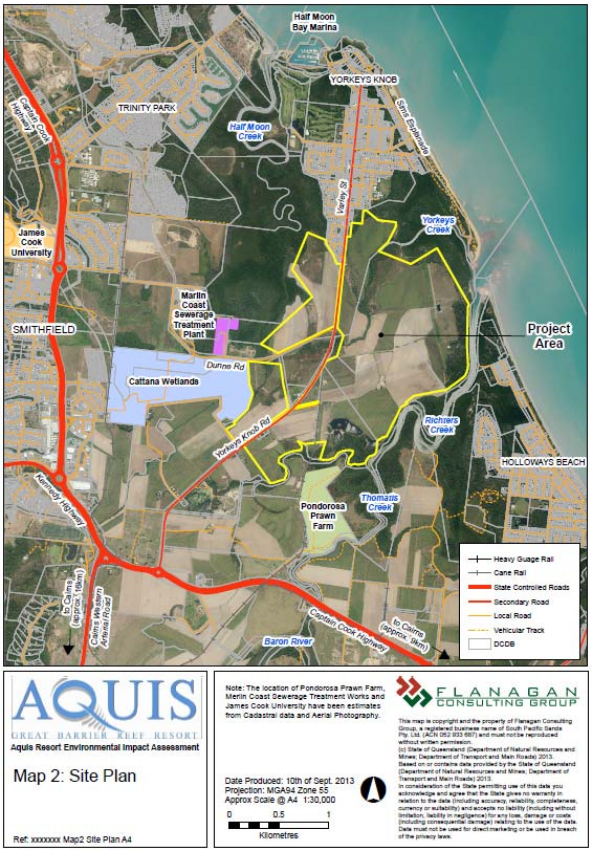


**Figure 3-2** Site plan

Details of the site and its surrounds are provided throughout this chapter. In this EIS the following terminology is used to describe geographic areas:

- the ‘site’, ‘project site’ (or ‘project area’ in the ToR) is the land occupied by the lots shown on **Figure 3-3**
- the ‘study area’ is a larger area containing these lots and adjacent areas to the extent that these are relevant to the matter under discussion (defined where appropriate in the EIS text).

## 3.2 RP DETAILS, TENURE AND EASEMENTS

### 3.2.1 Lots Comprising the Site

The site comprises 11 freehold titles as shown on **Figure 3-3**. These lots are currently under option to purchase by the proponent and have a total area of 340.63 ha (including an easement and excluding a reserve for esplanade) as detailed in **Table 3-1**.

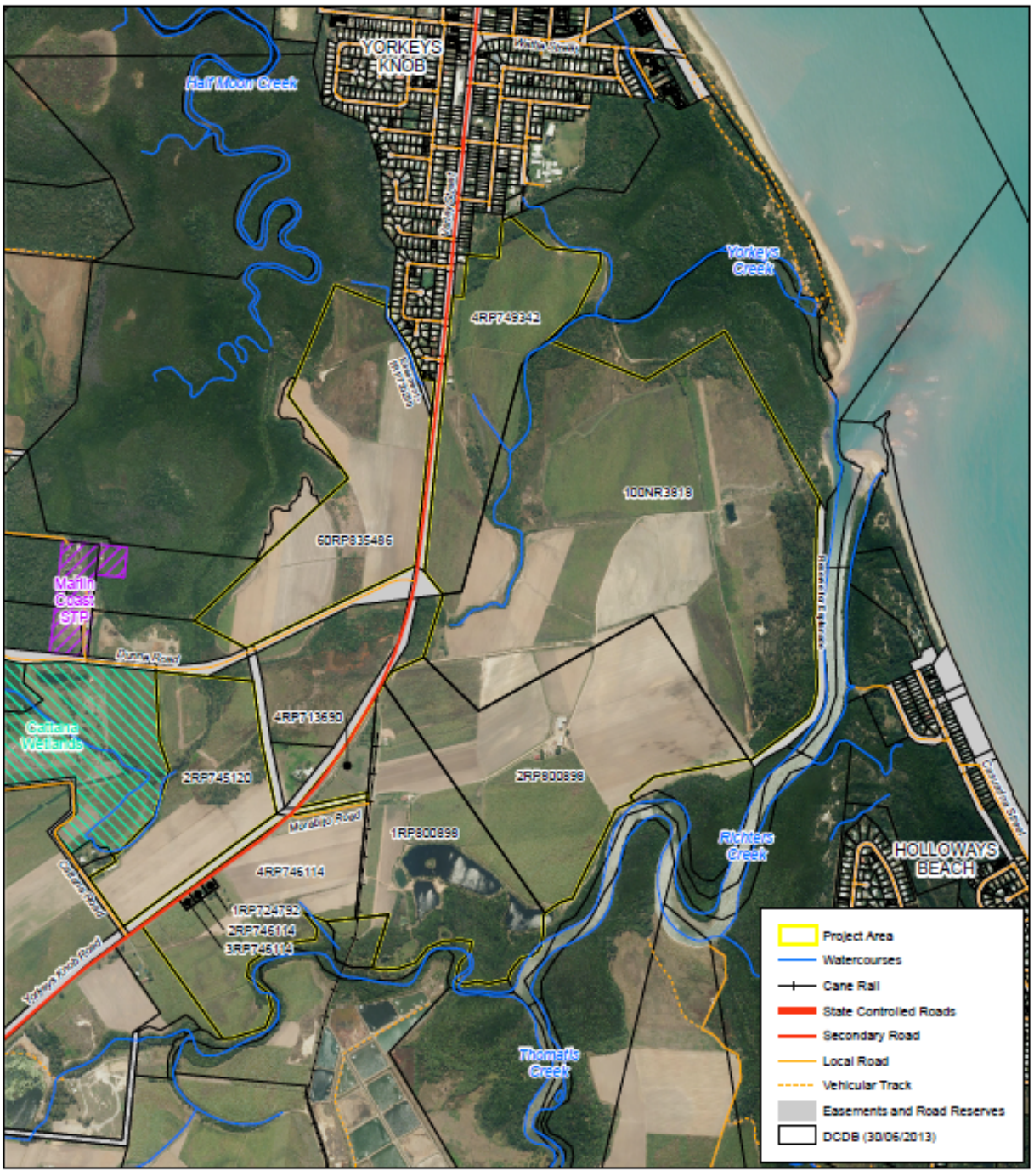


**Figure 3-3** Real Property Details.

**TABLE 3-1 LOTS COMPRISING THE SITE**

| Lot and plan | Title reference | Area (ha) | Tenure | Road frontage |
|---|---|---|---|---|
| Lot 100 on NR3818 | 20983091 | 119.521 | Freehold | Yorkeys Knob Road and Richters Creek Esplanade |
| Lot 1 on RP800898 | 21449027 | 34.245 | Freehold | Yorkeys Knob Road |
| Lot 2 on RP800898 | 21449028 | 53.914 | Freehold | Yorkeys Knob Road |
| Lot 2 on RP745120 | 21343157 | 26.331 | Freehold | Yorkeys Knob Road and Dunne Road |
| Lot 60 on RP835486 | 21027116 | 43.252 | Freehold | Yorkeys Knob Road and Dunne Road |
| Lot 4 on RP713690 | 20503245 | 3.507 | Freehold | Yorkeys Knob Road |
| Lot 1 on RP724792 | 20864025 | 0.218 | Freehold | Yorkeys Knob Road |
| Lot 2 on RP746114 | 21360116 | 0.251 | Freehold | Yorkeys Knob Road |
| Lot 3 on RP746114 | 21360117 | 0.200 | Freehold | Yorkeys Knob Road |
| Lot 4 on RP746114 | 21360118 | 28.791 | Freehold | Yorkeys Knob Road |
| Lot 4 on RP749342 | 21418082 | 30.421 | Freehold | Yorkeys Knob Road |
| **Total** | | **340.63** | | |

**Source**: Study team compilation based on the Queensland Government Digital Cadastral Data Base (DCDB).

The lots are accessed by either Yorkeys Knob Road or Dunne Road as designated above.

### 3.2.2 Reserves and Easements

Several road reserves, road allowances, and easements exist over the land as tabulated below.

**TABLE 3-2 EASEMENTS**

| Lot | Easement number (area) | In favour of | Purpose |
|---|---|---|---|
| Lot 60 on RP835486 | FRP 730250 (0.587 ha) see Note 1 | CRC | Drainage |
| Lot 100 on NR3818 | Road (2.869 ha) see Note 2 | Queensland Government | Reserve for esplanade (30 m wide) |
| Unallocated road | Lot 100 NR3818 see Note 3 | Queensland Government | Future road |

**Source**: Study team compilation based on DCDB. See Notes below.

**Notes**:

**1** The DCDB shows that the area of FRP 730250 is included in the area of Lot 60 on RP835486.

**2** The DCDB shows that the area of esplanade is additional to the area of Lot 100 on NR3818 and that the esplanade is outside the lot. The original survey plan, however, shows the esplanade as being within the lot. A review of areas shows that the esplanade area has been removed twice from the lot. This anomaly is not critical to this EIS and can be attended to in a detailed survey to be undertaken prior to detailed design.

## 3.3 SENSITIVE ENVIRONMENTAL AREAS

Although the site is largely cleared, it is surrounded to the north-west, north, north-east, and south-east by remnant coastal vegetation and marine areas, most of which are sensitive environmental areas protected under a raft of Queensland legislation. Off-shore from low water lies the Great Barrier Reef World Heritage Area (GBRWHA) while the Great Barrier Reef Marine Park (GBRMP) lies some 3.8 km further off-shore. The key environmental features surrounding the Aquis Resort site are:

- protected areas (e.g. the GBRWHA, Queensland Marine Park (Great Barrier Reef Coast Section), the Yorkeys Creek FHA (FHA-034) – Area B and the Half Moon Creek FHA (FHA-033) – Area B
- regional ecosystems (REs) – small areas of 'Of concern' and 'Least concern' regional ecosystems as listed under the *Vegetation Management Act 1999* (Qld) (VM Act) around the fringes of the site
- wetlands – of various types and values.

Key ecological features are shown on **Figure 3-4**. Further details are provided in **Chapter 7** (Flora and Fauna).

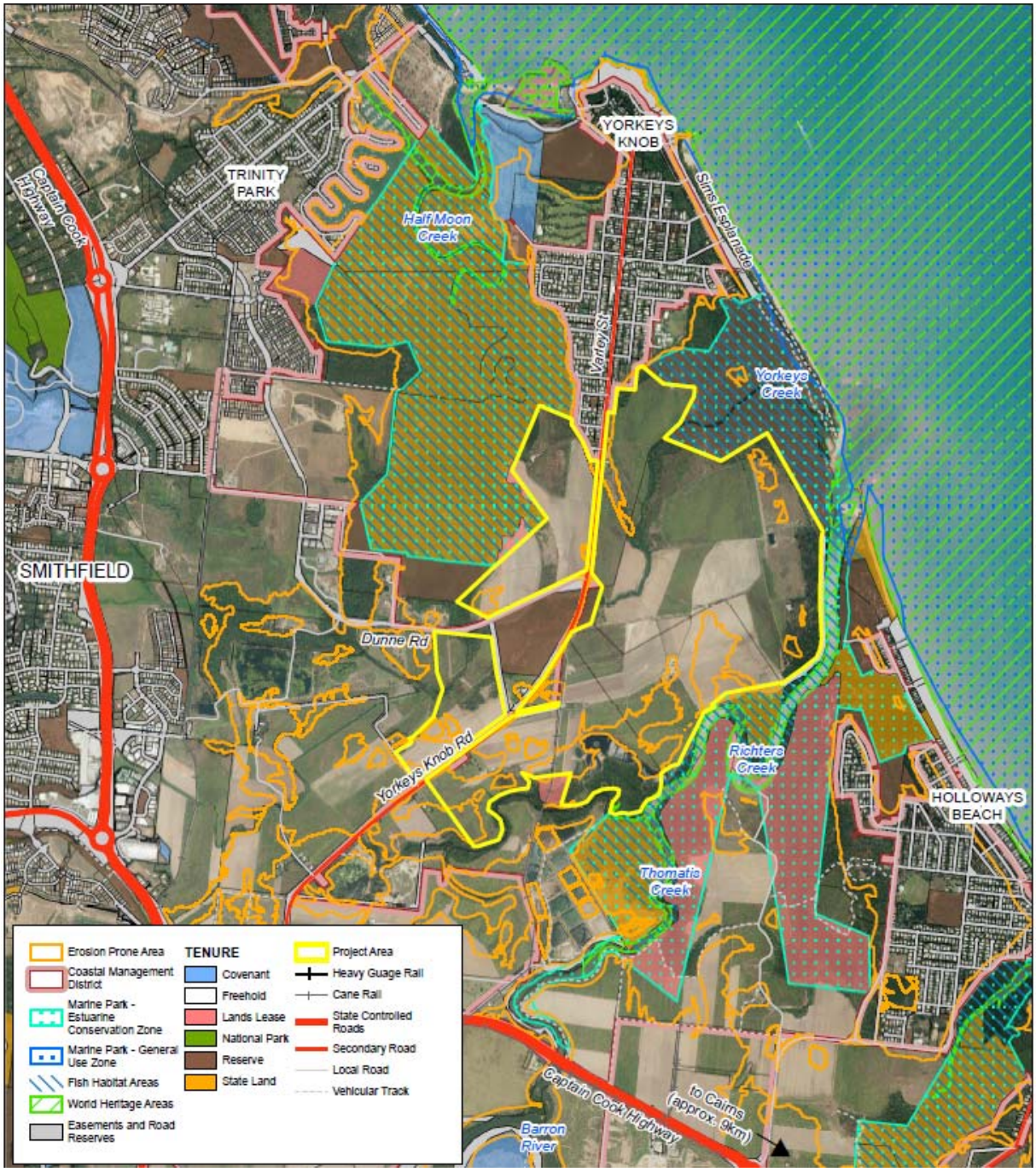


**Figure 3-4** Sensitive Environmental Areas (Environmental Context).

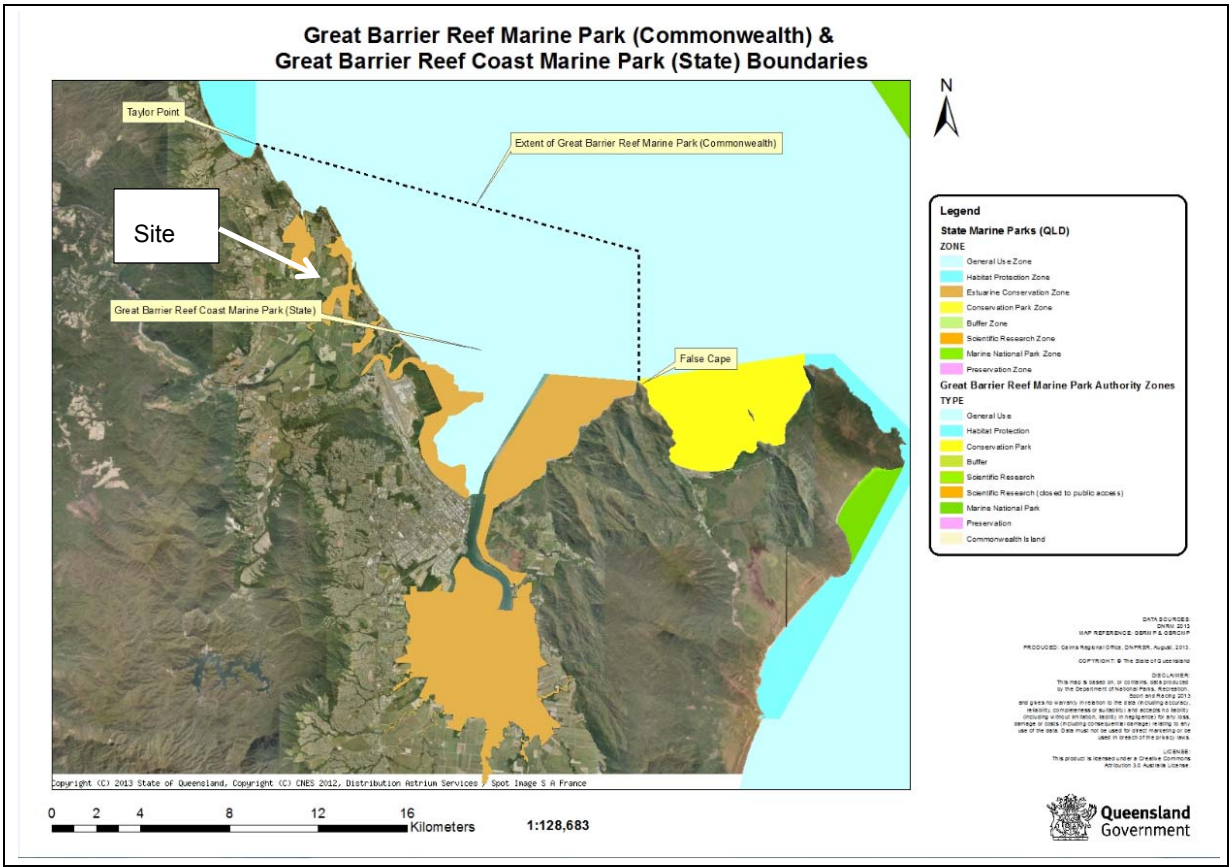


**Figure 3-5** Great Barrier Reef Marine Park (Commonwealth) and Great Barrier Reef Coast Marine Park (State).

**Source:** Queensland Government.

Most of the above features are described in the State Planning Policy (SPP) 2013 under *Planning for environment and heritage (Biodiversity)* and are either:

- Matters of National Environmental Significance (matters of NES) or
- Matters of State Environmental Significance (matters of SES).

The site contributes to and is part of the ecological functioning of the broader study area. Importantly, the maintenance of ecological values of the site and its surrounds depends on the continuation of key landscape-scale ecological processes/functions, namely:

- connectivity of habitats (terrestrial connectivity)
- watercourses that permit the free movement of aquatic fauna (aquatic connectivity)
- absence of pollution of surface and groundwater (water quality)
- maintenance of overland flows under natural flooding regimes.

Further details are provided in **Chapter 7** (Flora and Fauna) and **Chapter 22** (Matters of NES).

## 3.4 NATIVE TITLE

Native title is administered by the *Native Title Act 1993* (Cwlth) (NTA). Three situations occur for the site and surrounds:

- As native title has been extinguished on all freehold land within the site, no native title compliance actions under the NTA are required for any works or activities conducted within the boundaries of the site.
- Native title has been extinguished by a validly declared road or the valid construction of certain other public works

Native title still exists on various areas external to the site including:

- areas of unallocated state land (USL)
- reserves, and in particular Lot 139 NR3838 – an area of state marine park and Fish Habitat Area (FHA)
- the bed and banks of Richters Creek.

The NTA distinguishes between on-shore and off-shore areas. In summary, an on-shore area for the State of Queensland extends down to the low water mark and includes internal bodies of waters such as rivers, canals and heavily enclosed bays (and islands off the coast of Queensland down to the low water mark). On this basis, Richters Creek will be considered on-shore for the purposes of the NTA.

## 3.5 TOPOGRAPHY

### 3.5.1 Landform

The site is situated in the Barron River delta at the seaward end of the catchment and more specifically, within the sub-catchments of Richters Creek, Yorkeys Creek, and Half Moon Creek.

As shown on **Figure 3-6** and **Figure 3-7**, elevation typically varies from less than 1 m Australian Height Datum (AHD – this is the recognised basis of elevation and is approximately mean sea level) to 5 m AHD but is generally between about 1 and 3 m AHD. For comparison, the Highest Astronomical Tide (HAT) at Cairns is 1.86 m AHD, meaning that some of the site is below the highest high tides. East of Yorkeys Knob Road the land falls gently to the north and north-east towards Yorkeys Creek and Richters Creek while the western lots drain northward into Half Moon Creek.

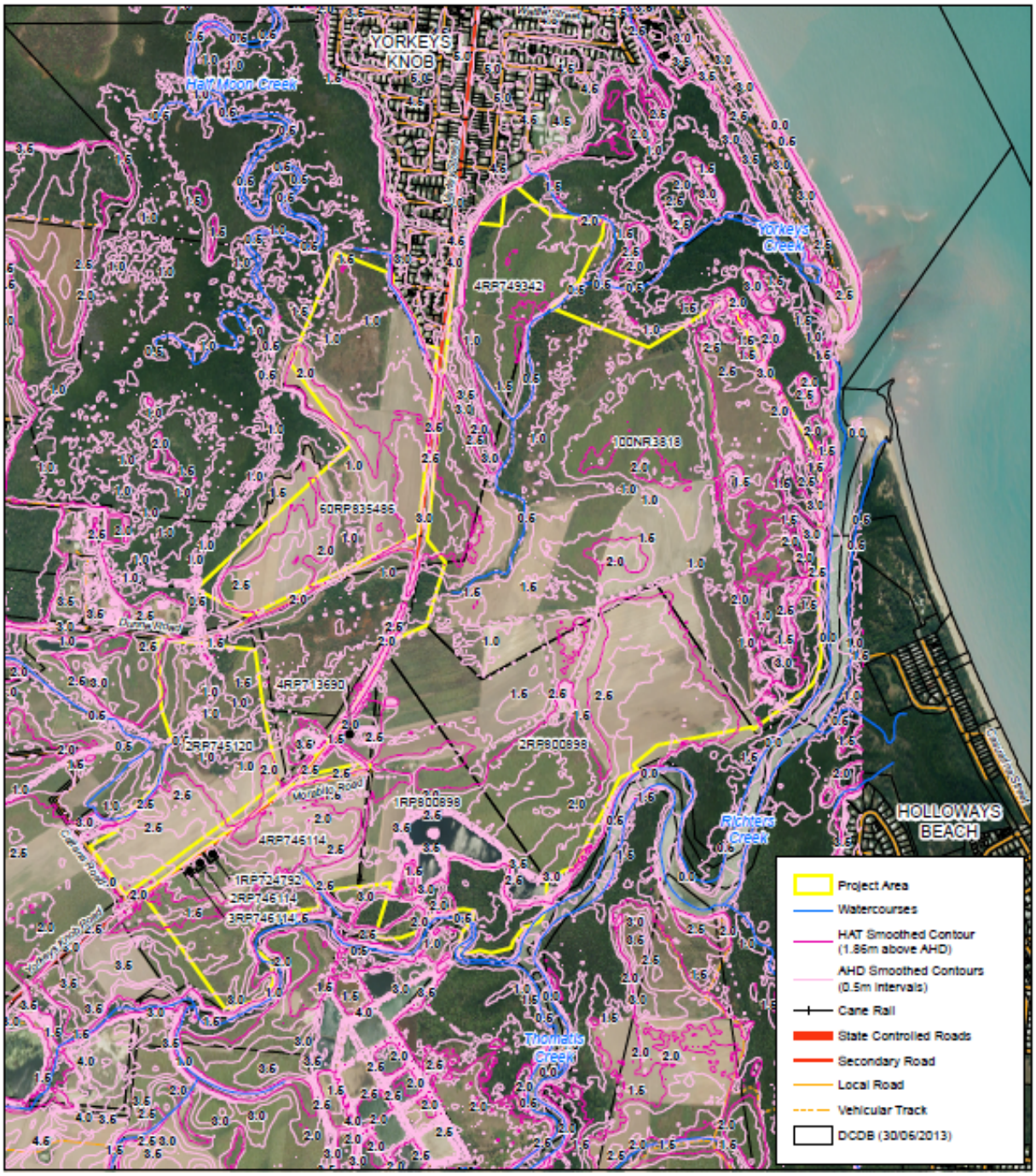


**Figure 3-6** Topography – Contours.

Due to the extremely flat nature of the land, this contour plan is quite complex. **Figure 3-7** shows the same information in shaded 0.5 m contour bands.

There is a well-established dune system north and north-east of Lot 100 NR3818 where the land rises to approximately 3 m AHD. This higher land, and the ridge between the eastern and western lots, forms the watershed between Yorkeys Creek to the east and Half Moon Creek to the west. The only other notable topographic feature is Richters Creek that flows along the south-eastern and eastern boundary of the site.

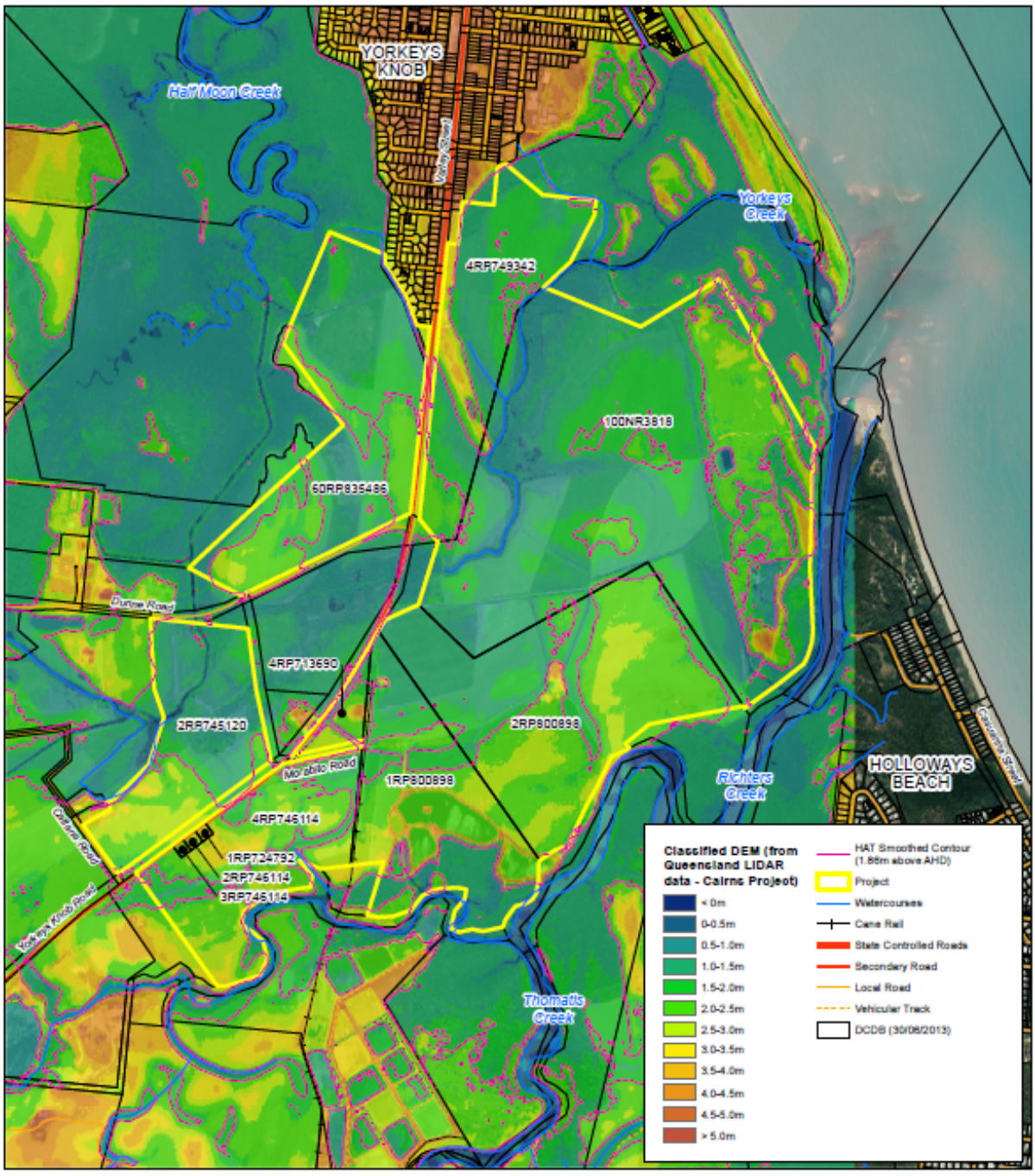


**Figure 3-7** Topography (Shaded 0.5 m Contour Bands).

### 3.5.2 Tide Levels On-site

**Figure 3-8** shows contours related to tide levels on the site, namely:

- HAT (1.86 m AHD)
- HAT with a 40 m landward offset (of relevance to coastal management issues)
- HAT assumed for the year 2100 (i.e. with an assumed 0.8 m sea level rise to the year 2100 – see **Section 3.6.6**) (2.66 m AHD)

Mean High Water Spring (MHWS) (0.98 m AHD).

These contours are of relevance in the discussion of coastal erosion (see **Chapter 8** – Coastal Processes).

Contours shown are based on a terrain model constructed using aircraft-mounted Light Detection and Ranging (LiDAR) equipment and associated data processing. On areas such as the site where there is very flat land with extensive micro-relief and drainage channels, there can be significant horizontal error in locating areas of tidal inundation. Other indicators are more reliable, such as the location of marine plants. This method of determining contours is appropriate for concept development and impact assessment.

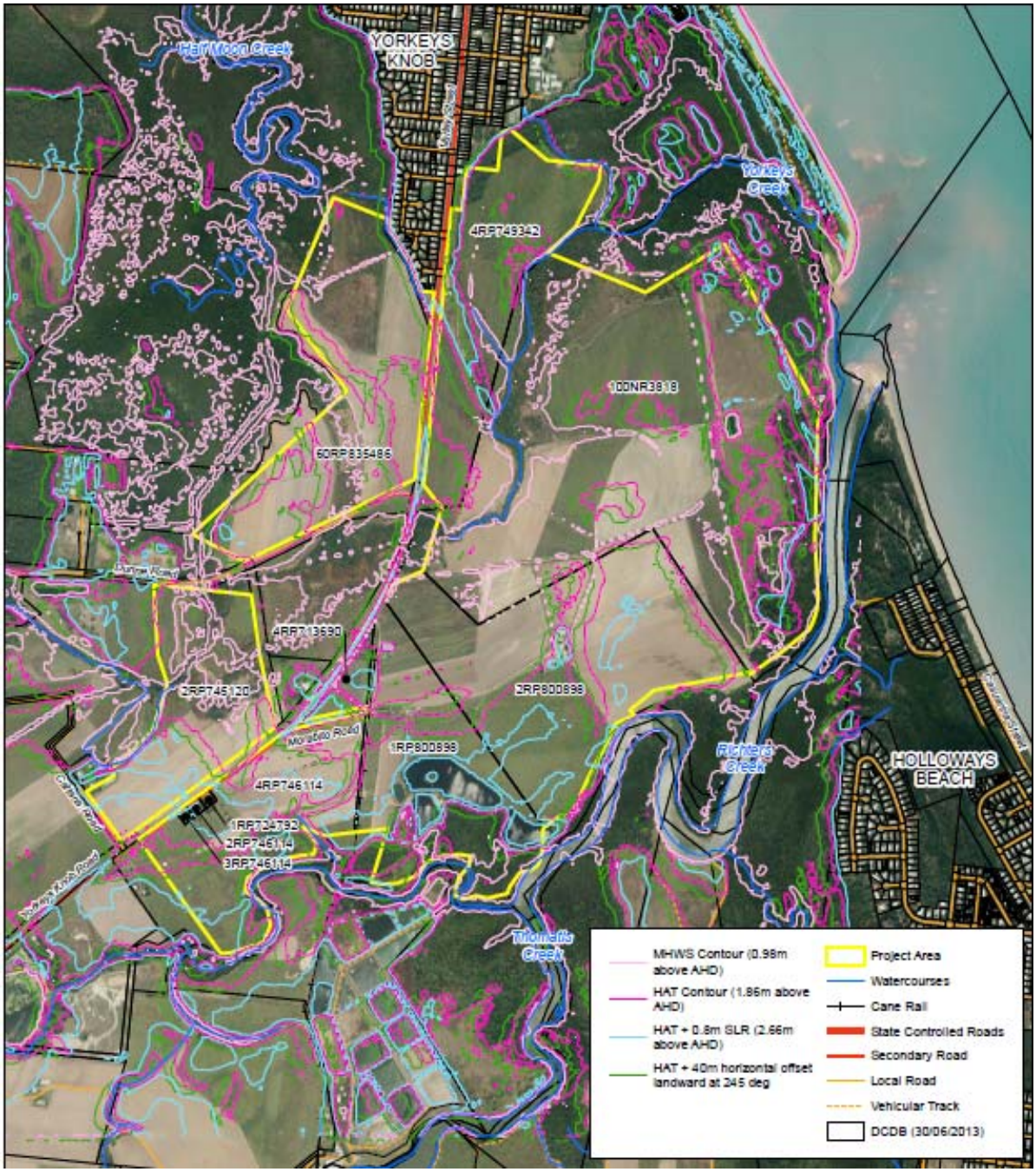


**Figure 3-8** Areas subject to tidal inundation at various tides.

Part of the site is within a designated Erosion Prone Area 400 m wide around the Richters Creek estuary, with a transition to 70 m towards the north. This is discussed further in **Chapter 8** (Coastal Processes).

## 3.6 CLIMATE

### 3.6.1 Overview

Yorkeys Knob is located within the wet-tropics climate zone. **Table 3-3** provides a summary of climate statistics from the Bureau of Meteorology (BoM) station, Cairns Aero (Station 031011). This rainfall station is located approximately 6.5 km south of the site and has records from 1942 to the present. It has the most accumulated data and least amount of missing data and is therefore the most reliable gauge in the area. Further, given the proximity to the coast, similar topography and relatively close proximity of this rainfall station to the site, the climate data is expected to be representative of climate at the site.

The Cairns region experiences generally hot and humid summers and milder drier winters. The summer months (January to March) are when the majority of rainfall occurs and as such there are defined wet and dry seasons for the area. Average annual rainfall is approximately 2000 mm over approximately 154 days. The majority of flood events occur between the months of January to March.

Relatively intense days of rainfall (>25 mm) account for approximately half of Queensland's rainfall. **Table 3-3** indicates that, on average, the Cairns region has 21 days of heavy rain per year.

**TABLE 3-3 SUMMARY OF CLIMATE STATISTICS FROM THE CAIRNS AERO**

| PARAMETER | MONTH | | | | | | | | | | | | AVG |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
| Mean maximum temperature ($^0$C) | 31 | 31 | 31 | 29 | 28 | 26 | 26 | 27 | 28 | 30 | 31 | 31 | 29 |
| Mean minimum temperature ($^0$C) | 24 | 24 | 23 | 22 | 20 | 18 | 17 | 17 | 19 | 21 | 22 | 23 | 21 |
| Mean rainfall (mm) | 395 | 451 | 424 | 195 | 91 | 45 | 29 | 27 | 34 | 47 | 94 | 179 | 2007 |
| Highest rainfall (mm) | 1417 | 1287 | 1128 | 635 | 322 | 144 | 145 | 140 | 103 | 394 | 372 | 919 | 3149 |
| Lowest rainfall (mm) | 86 | 30 | 28 | 13 | 3 | 3 | 0 | 0 | 0 | 0 | 3 | 9 | 721 |
| Highest daily rainfall (mm) | 368 | 286 | 403 | 186 | 90 | 70 | 38 | 63 | 80 | 206 | 185 | 230 | 403 |
| Mean no. of days of rain | 18 | 19 | 19 | 18 | 14 | 10 | 9 | 8 | 8 | 8 | 10 | 14 | 155 |
| Mean no. of days of rain >=1 mm | 16 | 16 | 16 | 15 | 10 | 7 | 6 | 5 | 5 | 6 | 8 | 11 | 120 |
| Mean no. of days of rain >=10 mm | 8 | 10 | 8 | 5 | 3 | 1 | 1 | 1 | 1 | 1 | 3 | 4 | 45 |
| Mean no. of days of rain >=25 mm | 5 | 5 | 5 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 21 |

**Source**: Bureau of Meteorology.

### 3.6.2 Cyclones

Cyclones have wind gusts in excess of 90 km / h around their centres and, in the most severe cyclones gusts can exceed 280 km / h. These very destructive winds can cause extensive property damage and are a risk to human life.

Heavy rainfall associated with the passage of a tropical cyclone can produce extensive flooding which can cause further damage to infrastructure. Heavy rains can persist as the cyclone moves inland and decays, hence flooding due to a decayed cyclone can occur a long way from the tropical coast as the remains of a cyclone move into central and southern parts of the continent. The destructive winds accompanying tropical cyclones also produce increased water levels in the ocean (storm surges) and this can add to the threat of coastal erosion and flooding.

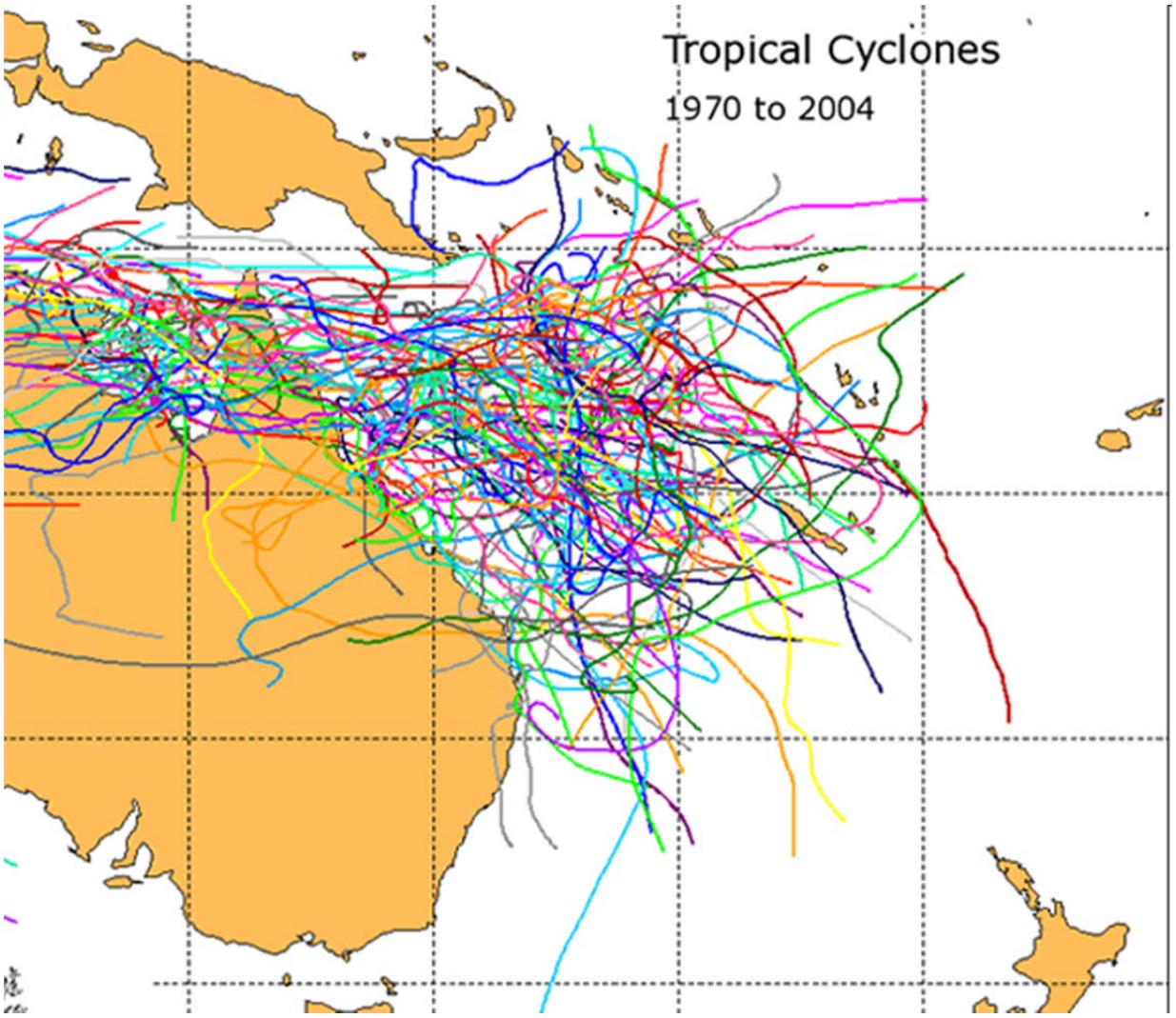


**Figure 3-9** Cyclone Paths.

**Source**: Bureau of Meteorology.

As shown on the above figure, cyclones can approach the Cairns area from any direction. In terms of local topography and coastal processes, a cyclone that makes landfall just north of Cairns is expected to produce the worst result in terms of flooding (principally on the northern beaches) and risk to human life. Further information on cyclones is provided in the discussion of hazards in **Chapter 12** (Hazards).

### 3.6.3 Rainfall

Rainfall data was obtained from the Bureau of Meteorology (BoM) web site for the Cairns Aero station. This is shown graphically on **Figure 3-10** to **Figure 3-12**.

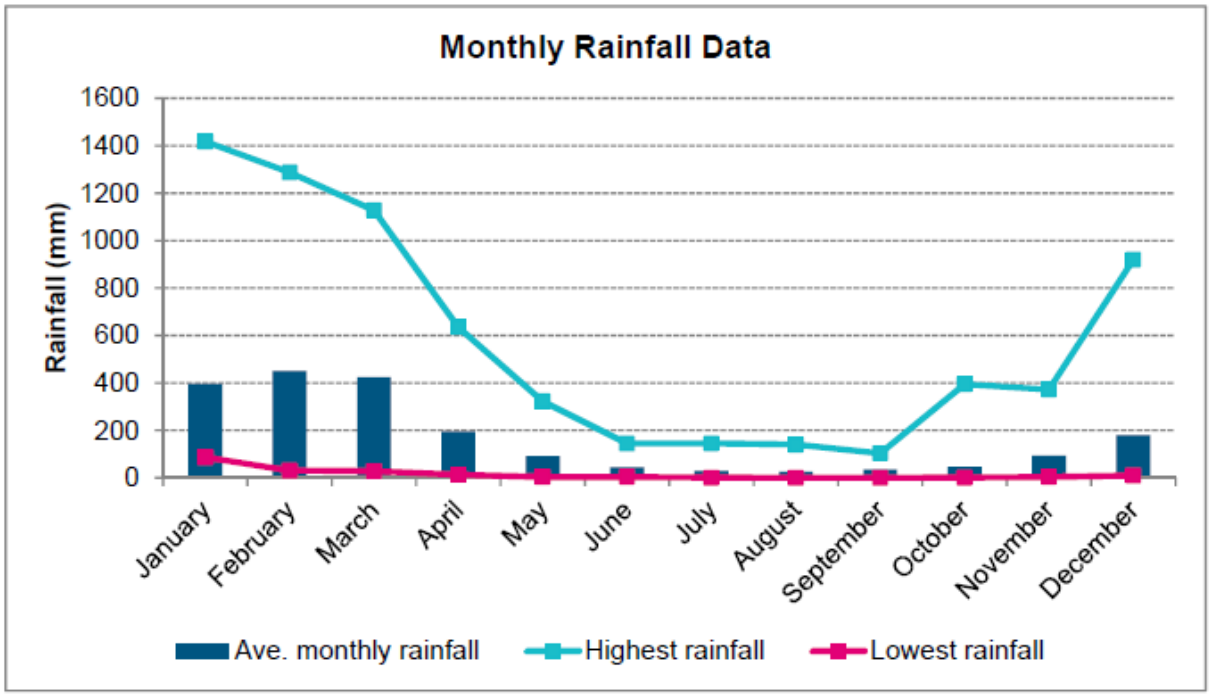


**Figure 3-10** Monthly rainfall.

**Source**: Bureau of Meteorology.

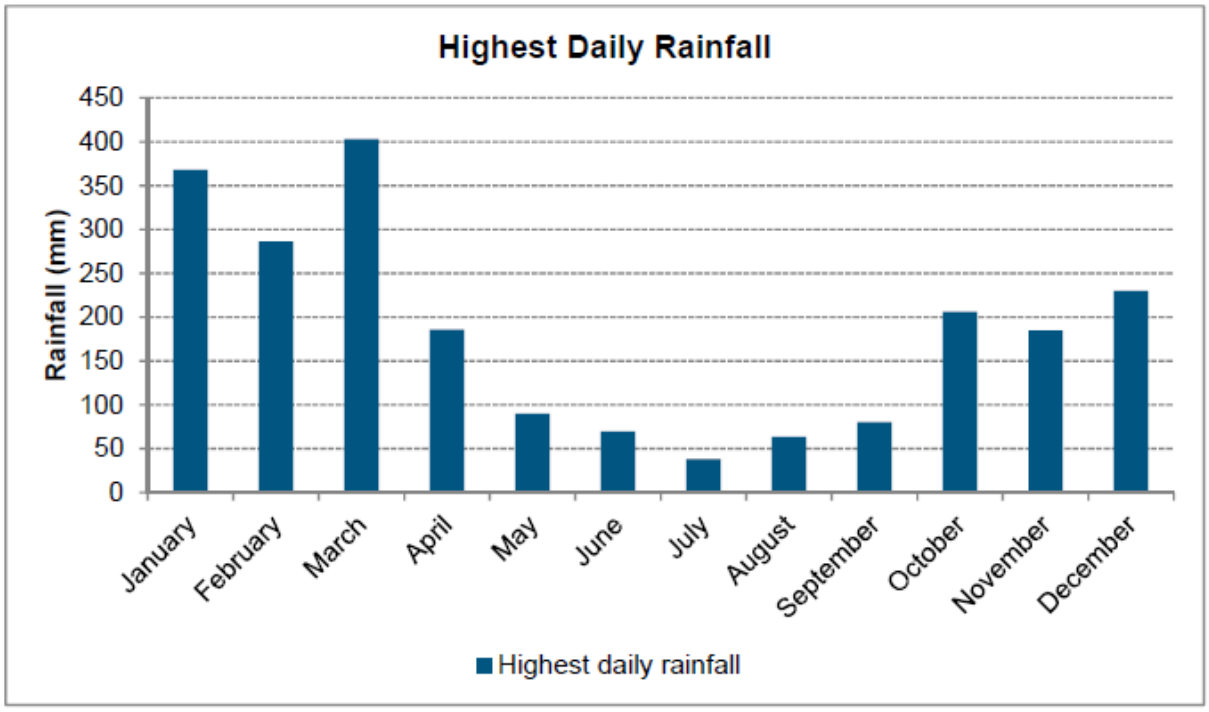


**Figure 3-11** Highest daily rainfall.

**Source**: Bureau of Meteorology.

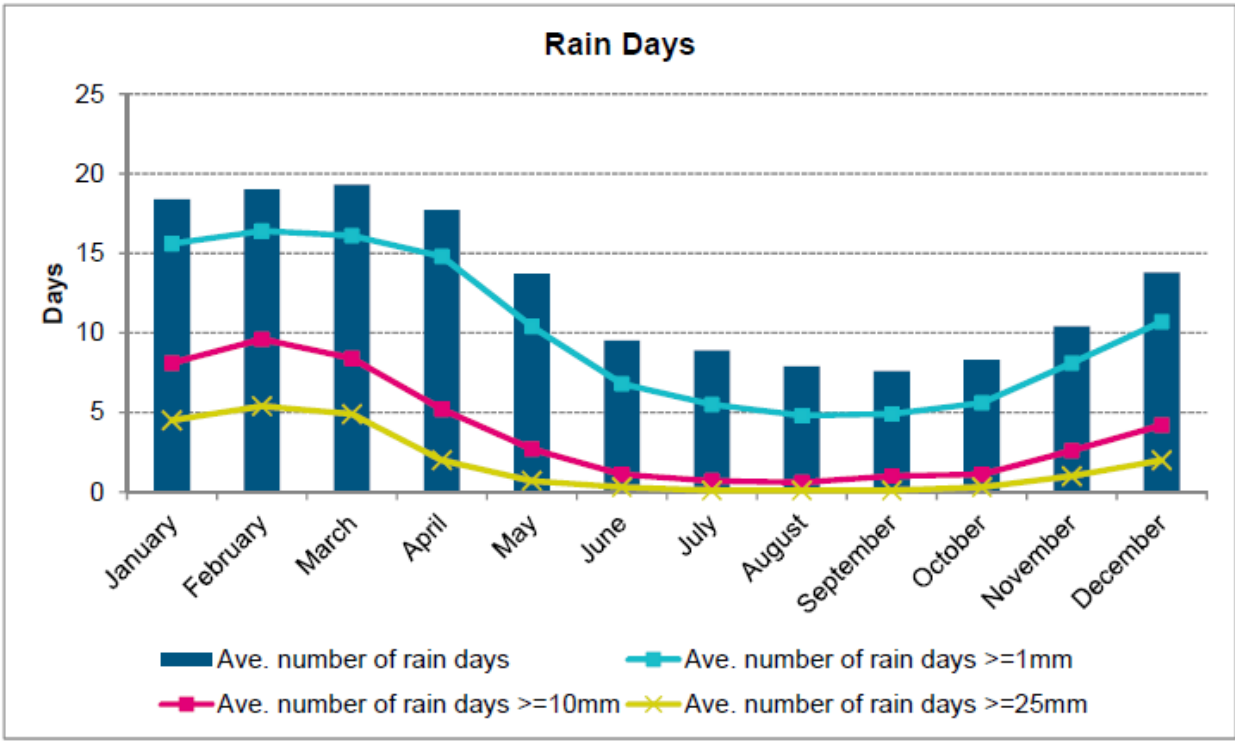


**Figure 3-12** Number of Rain Days.

**Source**: Bureau of Meteorology.

The following key points can be derived from this data:

- Rainfall data collected at Cairns Aero shows that February is the wettest month, with an average rainfall of 450.6 mm over 16 days.
- July and August experience the lowest rainfall and number of rain days.
- The average annual rainfall recorded at Cairns Aero is 2,009 mm for an average of 120 rain days, most of which falls in the six month wet season from late November to early May.

### 3.6.4 Temperature

Mean monthly minimum and maximum data was obtained from the BoM web site. This is shown graphically on **Figure 3-13** and **Figure 3-14**.

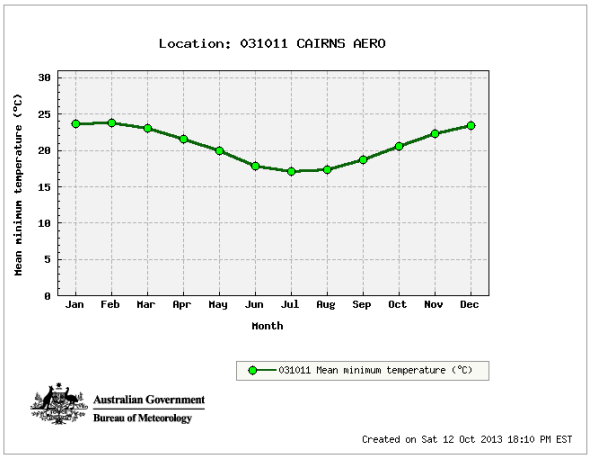


**Figure 3-13** Mean Minimum Temperature.

**Source:** Bureau of Meteorology.

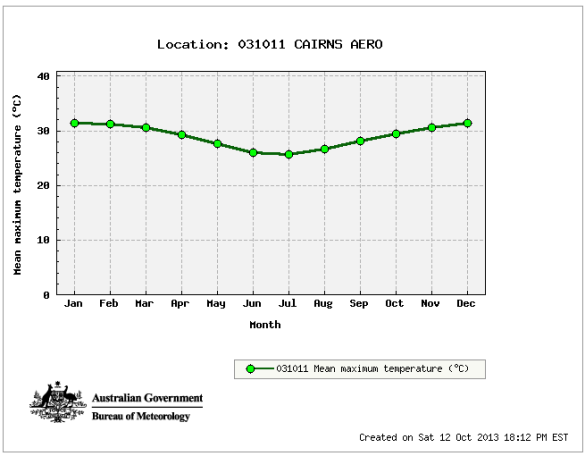


**Figure 3-14** Mean Maximum Temperature.

**Source:** Bureau of Meteorology.

The following key points can be derived from this data:

- Average minimum and maximum daily temperatures are 20.8°C and 29.0°C respectively.
- July is the coldest month, with average minimum temperature of 17.1°C.
- On average, January and December are the hottest months, with an average maximum temperature of 31.4°C.
- The annual average humidity reading collected at 9 am is 73%, and at 3 pm the annual average is 62%.
- On average, the months with the highest humidity are February and March with 9 am averages of 78%, and the lowest is September with a 3 pm average of 55%.

### 3.6.5 Winds

Annual wind rose diagrams for 9 am and 3 pm were obtained from the BoM web site as shown on **Figure 3-15** and **Figure 3-16**.

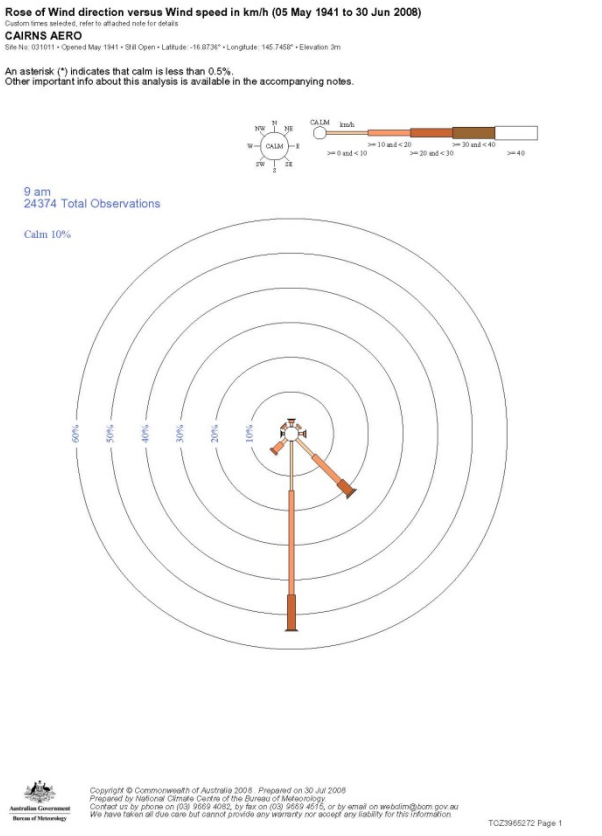


**Figure 3-15** Annual average wind rose data 9 am.

**Source:** Bureau of Meteorology.

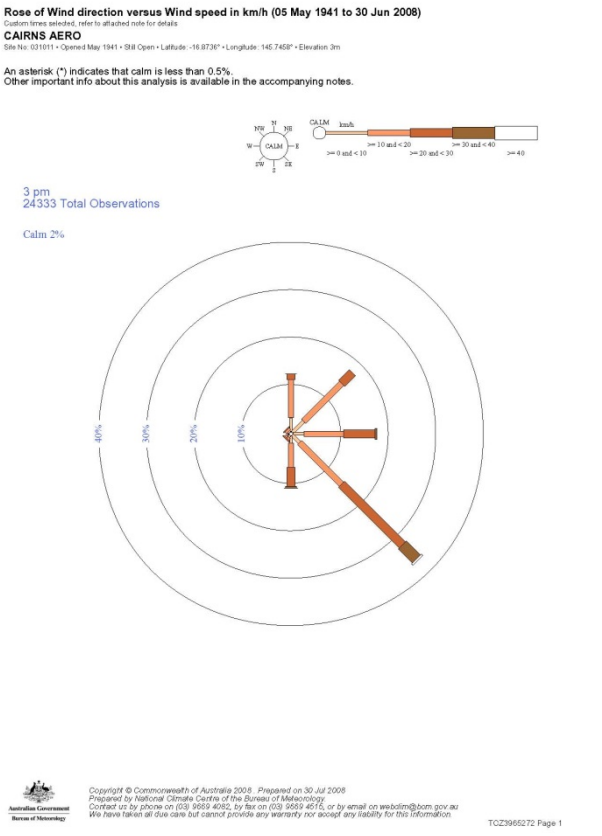


**Figure 3-16** Annual average wind rose data 3 pm.

**Source:** Bureau of Meteorology.

Wind speed and direction data is in the form of ‘speed’ (m/s) and ‘direction blowing from’ respectively. Frequency indicators on the roses specify percentage of occurrence. The following key points can be derived from this data:

- Highest wind speeds are normally associated with winds from the south-east.
- During the night the average wind speed is lower than the average wind speed during the day.
- The wind direction is predominantly from the south-eastern quadrant.
- The wind direction during the morning is predominantly from the south-south-east and south-east.
- The wind direction during the afternoon is predominantly from the south-east quadrant as well as some from the north to north-east.
- The meteorology is influenced by several factors, including the local terrain and land use. On a relatively small scale, winds are expected to be largely affected by the local topography but in general the above conclusions are valid for the study area as a whole.

### 3.6.6 Climate Change

Sea Level Rise

Consideration needs to be given to the effect on coastal process and flooding of expected sea level rise (SLR) due to the greenhouse effect. Sea level rise predictions by the Intergovernmental Panel on Climate Change (2007) for the mid-case scenario, which have been adopted by EHP, are:

- 0.4 m for 2060 (50 years)
- 0.8 m for 2100 (100 years).

The Working Group 1 report, Physical Science Basis, released September 2013, reinforces the global sea level rise predictions and projects a higher rate of sea level rise than previously predicted.

*The Connell Wagner 2007 Flood Assessment Report* (see **Chapter 9** – Flooding) has been used by CRC (CRC) in the preparation of the Smithfield – Barron District Flood Inundation (ARI 100 year) Overlay Map which forms part of the relevant CairnsPlan 2009 flooding code. This assessment report adopts ocean tailwater for coincident flood events of 2.1 m AHD, which is highest astronomical tide (HAT) plus an allowance of 300 mm for sea level rise.

Other Climate Change Effects

The recent *Queensland rainfall – past, present and future* study (Office of Climate Change 2012) identified that for Queensland, extreme rainfall events have increased in their contribution to the annual rainfall total over the 20$^{th}$ century. Specifically for the Far North Queensland region, over the recent decade there has been a 21% increase in average winter rainfall and a 10% increase in average summer rainfall (compared to the 1961-1990 average). This increase, however, is well within the bounds of natural variability. Local factors including topography, vegetation and broader scale weather patterns (e.g. El Nino events) strongly influence annual and seasonal rainfall which results in this natural variability according to the study *Climate change in the Far North Queensland Region* produced by DERM (2009a).

At present, there is no state or local government requirement for consideration of increased or decreased rainfall and rainfall intensity due to climate change, with considerable uncertainty in the science underpinning such predictions. Although no definitive state or local government requirements are in place, the Queensland Government has published climate change predictions for Queensland and in particular for the Far North Queensland Region. The document *ClimateQ: toward a greener Queensland* (DERM 2009b) has published predictions for annual and seasonal rainfall for the year 2070 (low and high emissions scenarios) and states:

Annual rainfall is projected to decrease by two per cent (-25 mm) and three per cent (-38 mm) under low and high emissions scenarios respectively. The largest seasonal decrease under a high emissions scenario of 16 per cent (-21 mm) is projected for spring. (DERM 2009b)

For Queensland in general it is predicted that there will be a stronger but shorter rainfall season during January and February thus resulting in drier autumns. It is generally anticipated that the number of rainy days will decrease but the amount of rain falling on wet days may increase by up to 20%. Extreme rainfall events are predicted to also become more frequent during the summer months (Office of Climate Change 2012).