

# Tropical Cyclone Storm Tide Warning

Response System Handbook

12th Edition



**Australian Government**  
**Bureau of Meteorology**



**Queensland Government**

# Preface

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This Handbook has been jointly prepared by the Queensland Fire and Emergency Services (QFES) under the authority of the *Disaster Management Act 2003 (the Act)* s. 63, and the Australian Bureau of Meteorology (the Bureau), under the authority of the *Meteorology Act 1955*. The valuable contributions and technical advice in the preparation of this Handbook by the Queensland Department of Science, Information Technology and Innovation (DSITI) are acknowledged.

The Handbook will assist authorities responsible for the preparation and execution of plans dealing with risk to the community from storm surge generated by tropical cyclones in Queensland.

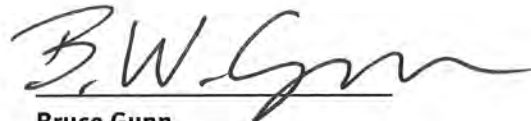
This Handbook replaces all earlier editions dealing with the Tropical Cyclone Storm Tide Warning-Response System in Queensland, and should be used when generating appropriate disaster district and local government disaster management plans for areas at risk from storm tides.

This Handbook complements the Queensland Evacuation Guidelines, which contain information on storm tide warning and evacuation.

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# Contents



<b>Preface</b>	<b>2</b>
<b>Contents</b>	<b>3</b>
<b>Acronyms</b>	<b>4</b>
<b>Tidal Levels</b>	<b>5</b>
<b>1. Storm Surge, Storm Tide</b>	<b>6</b>
<b>2. Agency Responsibility in Storm Tide Warning and Response</b>	<b>8</b>
<b>3. Storm Tide Warning Response System</b>	<b>11</b>
Overview	11
Storm Tide Warning	11
Standard Emergency Warning Signal (SEWS)	14
Technical considerations and local effects	14
Storm Tide Warning - Response System	15
Storm Tide Warning Graphic	16
An example of a Storm Tide Warning	17
<b>4. Disaster Management Response</b>	<b>19</b>
Overview	19
Queensland Evacuation Guidelines	20
Roles during a storm tide response	21
<b>5. Emergency Response Maps</b>	<b>24</b>
<b>6. Appendices</b>	<b>25</b>
Appendix A: Tidal Planes	25
Appendix B: Storm Tide Gauge Network	26
Appendix C: Tropical Cyclone Warning Service	27
Appendix D: Storm Tide Effects on Coastal Centres and Accompanying Maps and Tables	31
Appendix E: Storm Tide Warning and Graphic Locations	86
Appendix F: Useful Storm Tide References	88
Appendix G: Useful Web Sites	92
Appendix H: Maps and Figures Contained in this Document	93
Appendix I: Storm Tide Warning Quick Reference Guide	95

# Acronyms

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<b>Bureau</b>	Bureau of Meteorology
<b>DDC</b>	District Disaster Coordinator
<b>district group(s)</b>	district disaster management group(s)
<b>DDMG</b>	Disaster District Management Group
<b>DDO</b>	Declared Disaster Officer
<b>DEM</b>	Digital Elevation Model
<b>DSITI</b>	Department of Science, Information Technology and Innovation
<b>the Act</b>	Disaster Management Act 2003
<b>IGEM</b>	Inspector-General Emergency Management
<b>LDMG</b>	Local Disaster Management Group
<b>POCC</b>	Protecting our Coastal Communities Project
<b>QEG</b>	Queensland Evacuation Guidelines (refer to guidelines at <a href="http://www.disaster.qld.gov.au/Disaster-Resources/Documents/2907EMQ_SDMG_QLD_Evac%20Guide_web.pdf">http://www.disaster.qld.gov.au/Disaster-Resources/Documents/2907EMQ_SDMG_QLD_Evac%20Guide_web.pdf</a> )
<b>QDMA</b>	Queensland Disaster Management Arrangements
<b>QDMC</b>	Queensland Disaster Management Committee
<b>QFES</b>	Queensland Fire and Emergency Services
<b>QPS</b>	Queensland Police Service
<b>QTCCC</b>	Queensland Tropical Cyclone Consultative Committee
<b>SDC</b>	State Disaster Coordinator
<b>SDCC</b>	State Disaster Coordination Centre
<b>SDMP</b>	State Disaster Management Plan
<b>SES</b>	State Emergency Service
<b>SEWS</b>	Standard Emergency Warning Signal (refer to guidelines at <a href="http://www.disaster.qld.gov.au/Disaster-Resources/Documents/Standard%20Emergency%20Warning%20Signal%20SEWS.pdf">http://www.disaster.qld.gov.au/Disaster-Resources/Documents/Standard%20Emergency%20Warning%20Signal%20SEWS.pdf</a> )
<b>TCWC</b>	Tropical Cyclone Warning Centre
<b>TMST</b>	Theoretical Maximum Storm Tide



# Tidal Levels



<b>HAT</b>	<b>Highest Astronomical Tide</b>	The highest water level that can be predicted to occur at a particular site under average weather conditions. <u>This level may not be reached every year.</u>
<b>LAT</b>	<b>Lowest Astronomical Tide</b>	The lowest water level that can be predicted to occur at a particular site under average weather conditions. <u>This level may not be reached every year.</u>
<b>LWD</b>	<b>Low Water Datum</b>	Low Water Datum was superseded by the Lowest Astronomical Tide Datum in 1994.
<b>AHD</b>	<b>Australian Height Datum</b>	Australia's vertical datum which approximates mean sea level.
<b>PD</b>	<b>Port Datum</b>	Predicted heights of the Astronomical Tide found in <i>Tide Tables</i> are referenced to Port Datum which is equivalent to LAT.
<b>MSL</b>	<b>Mean Sea Level</b>	The average level of the sea over a long period (preferably 18.6 years) or the level of the sea in the absence of tides.
<b>MWL</b>	<b>Mean Water Level</b>	The mean surface level as determined by averaging the heights of the water at equal intervals of time. At the shoreline this includes wave setup and storm surge.
<b>SWL</b>	<b>Still Water Level</b>	The surface of the water if all wave and wind action were to cease.





## 1. Storm Surge, Storm Tide

- 1.1 The main threats from tropical cyclones come specifically from storm surge, high winds and torrential rain. Potentially the most dangerous of these phenomena is the 'storm surge'.
- 1.2 As a major cyclone approaches the coast, high winds whip up the sea generating currents which push a raised mound of seawater (referred to as a 'storm surge') onto the shore. This could be up to 50 kilometres or more across – and up to several metres high.
- 1.3 It is important to understand that a storm surge is not merely a travelling wave of short duration - but a massive three-dimensional movement of seawater that can last several hours. The storm surge comes across the shoreline like a rapidly rising tide. The danger lies in the fact that the sea level could exceed high water mark by some metres and flood coastal land.
- 1.4 The highest storm surges along Queensland's east coast usually occur on the immediate left hand side (relative to the direction of movement) of a land falling cyclone centre – just outside the eye and within the belt of strongest onshore winds. On Queensland's east coast, this is usually on the southern side of a land-falling cyclone. In the Gulf of Carpentaria this is usually on the eastern or northern side.
- 1.5 The storm surge height depends on a range of factors including: (a) intensity and size of the cyclone – the stronger the winds the higher the surge; (b) shape of the seafloor – the more gentle the slope the greater the surge; and (c) speed and angle of approach of the cyclone to the coast. The height can be worsened by funnelling effects of bays and estuaries, and river and local flooding caused by torrential rain.
- 1.6 Of most significance is the wind stress on the ocean surface. This produces an elevation of seawater level in areas of onshore winds and a depression in areas of offshore winds. The low pressure in the cyclone has a smaller affect.
- 1.7 Records of Queensland storm surges are very incomplete. The Bathurst Bay cyclone of 1899 allegedly produced a storm surge in excess of 10 metres with 307 lives lost at sea. Note that some recent surveys question this great height. Other notable surges include 3.7 metres at Mackay (1918); 3.6 metres just north of Townsville (Althea 1971); 3.3 metres in Upstart Bay near Ayr (Aivu 1989); 3 metres in the Gulf of Carpentaria (Barry 1996); 2.3 metres at Clump Point (Larry 2006); and 5.3 metres at Cardwell (Yasi 2011).
- 1.8 Storm surges up to 7 metres have been recorded in the eastern Gulf of Carpentaria, but could also occur (rarely) around most of the Gulf and in some east coastal areas with shallow gently sloping seabeds and bays.
- 1.9 Elevated sea levels are also the result of wave action, which is caused by the onshore mass transport of seawater. Note that wave action can have a battering effect on vulnerable structures near the shoreline.
- 1.10 The **storm tide** is the total water level obtained by adding the **storm surge** and **wave setup** to the height of the **astronomical tide** (refer Figure 1a and 1b below).
- 1.11 The **Theoretical Maximum Storm Tide** is determined by considering the worst-case scenario of the maximum potential storm surge coinciding with HAT.

Further information regarding tropical cyclone storm tide can be found at <http://www.bom.gov.au/cyclone/about/stormsurge.shtml>



Figure 1a: Depiction of 'normal' high tide, and storm tide<sup>1</sup>

\*Note: Storm Tide level does not include wave run-up

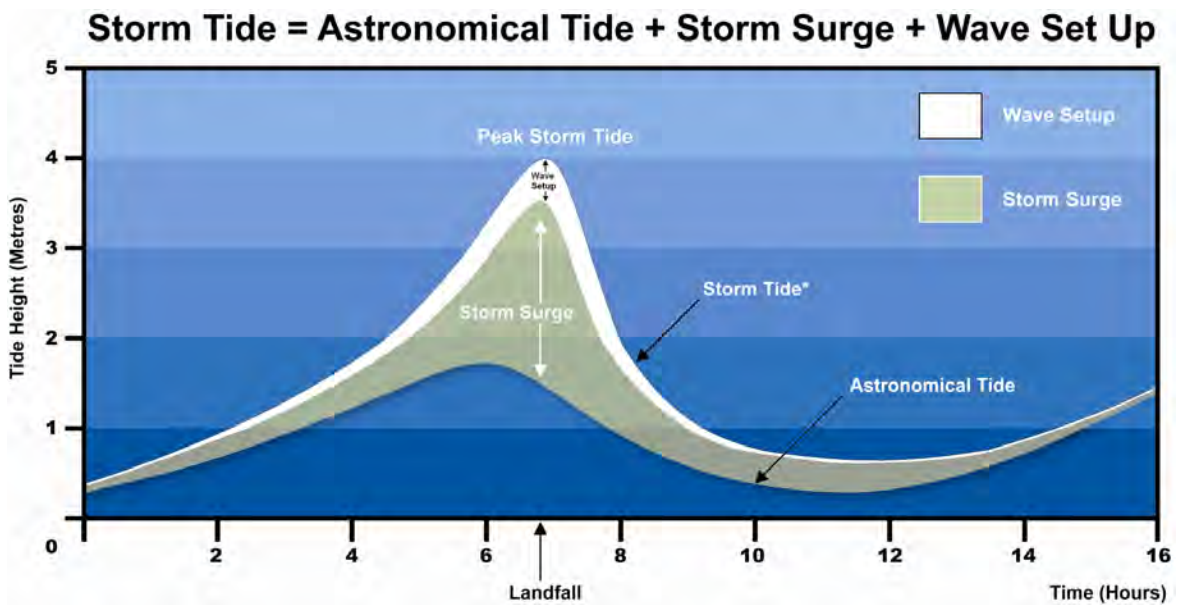


Figure 1b: Time series of a typical storm tide

<sup>1</sup> From <http://www.bom.gov.au/cyclone/about/stormsurge.shtml>

## 2. Agency Responsibility in Storm Tide Warning and Response

2.1 The *Disaster Management Act 2003 (the Act)* and the Strategic Policy Framework (SPF) guide the Queensland Disaster Management Arrangements (QDMA). The State Disaster Management Plan (SDMP) provides a detailed description of the QDMA. Groups have been established at local, district and state level to provide effective disaster management throughout Queensland. The QDMA structure enables, as required, a progressive escalation of support and assistance through the levels as outlined in Figure 2. More detailed information about these groups can be found in the SDMP.

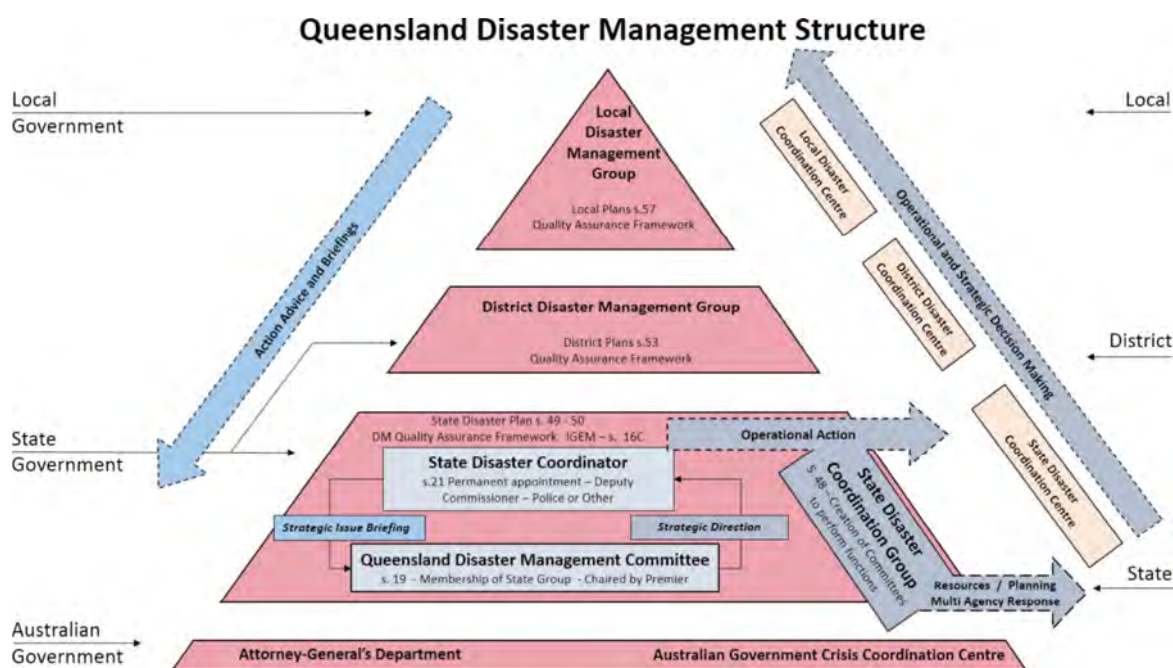


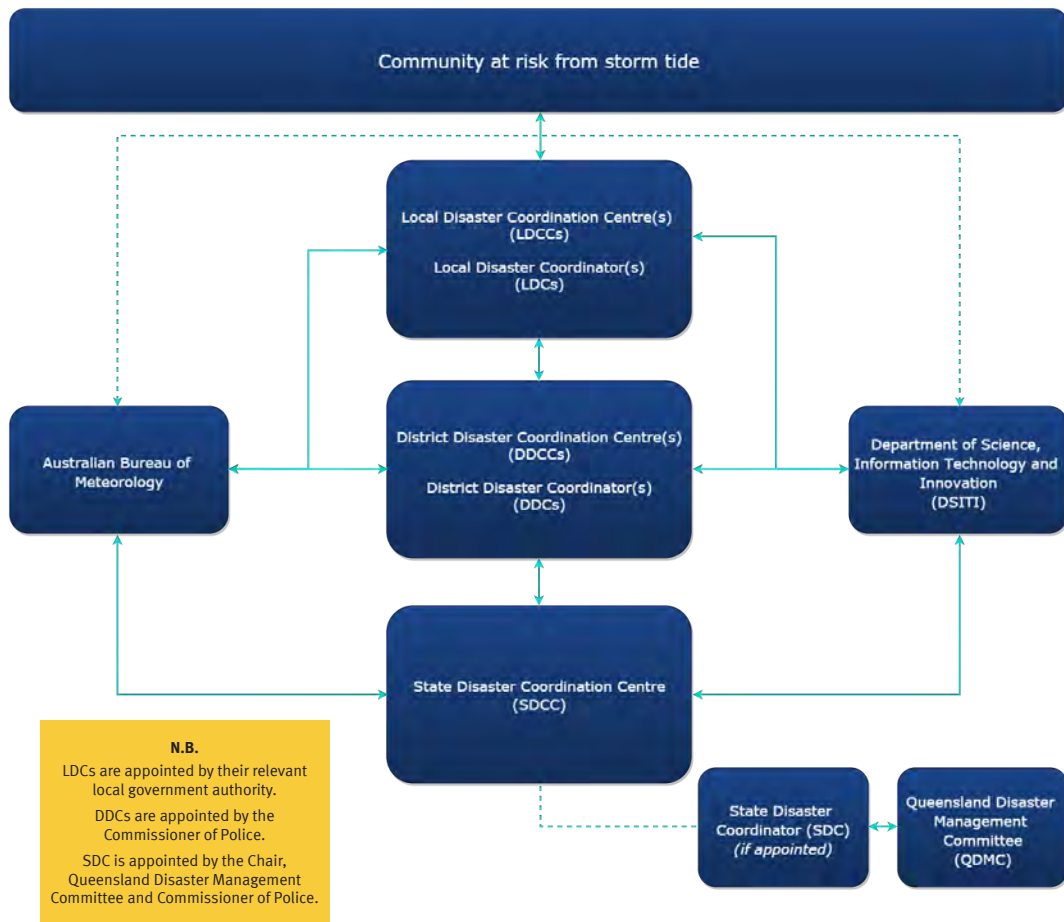
Figure 2: Queensland Disaster Management Arrangement Structure (from SDMP 2015)

- 2.2 Under the provisions of the Act, all District Disaster Management Groups (DDMGs) and Local Disaster Management Groups (LDMGs) are required to prepare disaster management plans to manage possible disasters (from all hazards including storm tide) in their respective areas.
- 2.3 Disaster coordinator roles that support each level of the disaster management arrangements (i.e. local, district and State) are described in Section 4 of this Handbook.
- 2.4 The following paragraphs provide an outline of the agencies involved in the management of a storm tide event in Queensland.
- 2.5 The **Bureau of Meteorology (the Bureau)** is a Commonwealth agency responsible for:
- Provision of forecasts, warnings and long term outlooks on environmental phenomena that affect the safety, prosperity and resilience of Australians;
  - Monitoring the progress of tropical cyclones and issuing public Tropical Cyclone Advises and Storm Tide Warnings as necessary. The Tropical Cyclone Warning Centre (TCWC) in Brisbane is the operational hub; and



- Being available to provide technical warning advice to the local, district and State groups before and during a storm tide event.
- 2.6 The **Department of Science, Information Technology and Innovation (DSITI)** is responsible for:
- Monitoring water levels using a network of storm tide gauges;
  - Liaising with the Bureau to confirm information in Storm Tide Warnings; and
  - Being available to provide technical advice on storm tide to the local, district and State groups before and during a storm tide event.
- 2.7 The **Queensland Fire and Emergency Services (QFES)** are responsible for providing advice and support to the local, district and State groups as per the role and responsibilities in the SDMP. Responsibilities include, but are not limited to:
- Establish and maintain arrangements between the state and Commonwealth about matters relating to effective disaster management.
  - Ensure that disaster management and disaster operations in the State are consistent with the State group's strategic policy framework; the State Disaster Management Plan, the disaster management standards and the disaster management guidelines.
  - Ensure that persons performing functions under the Act in relation to disaster operations are appropriately trained.
  - Provide advice and support to the State group and local and district groups in relation to disaster management and disaster operations.
  - Provide situational monitoring of events and incidents across the State via the SDCC Watchdesk.
- 2.8 The **Queensland Police Service (QPS)** responsibilities include, but are not limited to:
- Coordinate evacuation operations.
  - Coordinate the review and renewal of the SDMP.
  - Command the SDCC on activation.
  - Command the SDCC capabilities of operations and intelligence on activation.
  - Coordinate the review and renewal of the SDMP.
- 2.9 The **Inspector-General Emergency Management (IGEM)** is responsible for providing the Premier, Government and people of Queensland an assurance of public safety, through the establishment and implementation of an assurance framework to direct, guide and focus work of all agencies, across all tiers of Government to the desired outcomes of the disaster and emergency management arrangements for Queensland. The functions of the Inspector-General Emergency Management and the Office of the Inspector-General Emergency Management are prescribed in the Disaster Management Act 2003.

## Tropical Cyclone Storm Tide Warning-Response System



**Figure 3: Agency relationships within Queensland's disaster management arrangements**

## 3. Storm Tide Warning Response System

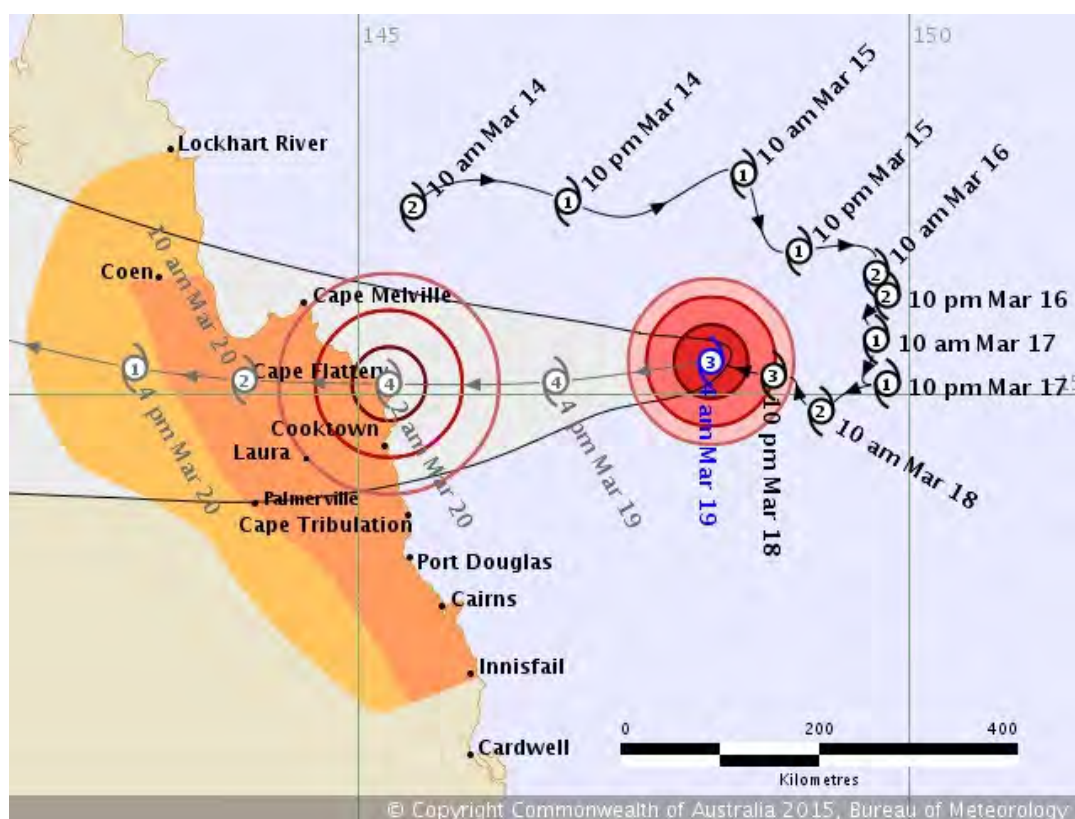
### Overview

- 3.1 Storm Tide Warnings are issued for the restricted information of disaster management authorities. Copies of these warnings are not issued to the media or the general community due to the technical expertise needed to interpret them. Unauthorised dissemination could adversely affect public safety. Any person with access to Storm Tide Warnings is not to pass copies to the media or the general community, who will be kept informed of any storm tide threat as necessary in Tropical Cyclone Advises. However, release of selected details of the warnings may be made in exceptional circumstances with prior agreement of the issuing authorities if considered to be in the public interest.
- 3.2 The Bureau activates the Storm Tide Warning Response System if it is anticipated that a storm tide could occur which would result in a total water level in excess of the Highest Astronomical Tide (HAT) in the area under threat. Estimates of the storm tide associated with the forecast cyclone track are provided for agreed locations. In addition, warnings provide estimates of storm tide under the ‘worst case’ assumption should the cyclone centre cross the coast near any of the locations near the time of high tide.
- 3.3 The Storm Tide Warning Response System is linked directly to the Tropical Cyclone Warning Response System. Refer to Figure 5 for a diagram of the Storm Tide Warning Response System and its linkage to the Tropical Cyclone Warning System.
- 3.4 During the Cyclone Information phase and prior to the declaration of a Cyclone Watch zone, if the forecast track map or text products show a cyclone crossing the coast, verbal briefings will be held with SDCC and DSITI Storm Tide Advisers. No additional storm tide products will be issued at this stage.
- 3.5 During a Cyclone Watch phase if the forecast track shows a cyclone crossing the coast, verbal briefings will continue as in the Cyclone Information phase. If the forecast track shows a tropical cyclone crossing the coast and there is a possibility that HAT will be exceeded, a Storm Tide Warning will be provided to the SDCC and to the DSITI Storm Tide Adviser. Storm Tide Warnings will be updated at 6 hourly intervals during the Cyclone Watch phase.
- 3.6 During a Cyclone Warning phase, if there is a possibility of HAT being exceeded, Storm Tide Warnings will be updated at 3 hourly intervals.
- 3.7 Storm Tide Warnings will, where possible, be issued at least 24 hours prior to the forecast onset of 100 km/h wind gusts affecting coastal and island communities with consideration given, where possible, to issuing Evacuation Orders during daylight hours.

### Storm Tide Warning

- 3.8 A **STORM TIDE WARNING** is issued during a Cyclone Watch or Cyclone Warning phase when a chance of a storm tide risk exceeding HAT is identified.
- 3.9 The warning specifies “worst case” scenario storm tide estimates for key locations, based on the locations in question experiencing a combination of conditions, within the bounds of forecast uncertainty, to produce a larger storm tide from a slightly more intense cyclone with a centre within the range of possibilities as depicted by the grey area on the most recent TC Forecast Track Map. Generally this would mean the cyclone impacting close to the location, such that it experiences maximum onshore winds at a time near to or at the local high tide. The storm surge and storm tide figures presented in this table generally do not represent the most likely outcome, which is represented by the “Forecast Track Scenario”. Storm tide heights in the warnings are referenced to Lowest Astronomical Tide (LAT), Australian Height Datum (AHD) and Highest Astronomical Tide (HAT).

- 3.10 The warning also specifies additional “forecast track” scenario estimates of the predicted storm tide for key locations, based on the most recent forecast track, and expected tide conditions at the forecast time of coastal crossing. Storm tide heights in the warnings are referenced to each of LAT, AHD and HAT.
- 3.11 The warnings also specify estimates of the time of onset of 100km/h winds at each of the locations. An estimate is provided of the time of onset based on the most likely forecast track, and in addition an estimate of the earliest possible time based on forecast track uncertainty. The outer ring (Strong Gale Force Wind Boundary) on the forecast track maps encloses the area in which wind gusts are estimated at 100 km/h or more (refer to sample forecast track map at Figure 4).
- 3.12 The warning will generally be updated with each update of the Tropical Cyclone Advice (see Appendix C) but at no more frequently than 3 hourly. This could vary if the danger of a storm tide is advanced in time or the portion of coastline under threat has significantly changed.
- 3.13 A **FINAL STORM TIDE WARNING** will be issued after the cyclone has crossed the coast or the chance of exceeding HAT has ceased.
- 3.14 It should be noted that whenever a threat exists, the Bureau would include a qualitative description of the expected storm tide impact in the routine Tropical Cyclone Advices to the general community. If tides are not expected to exceed HAT a statement to the effect that ‘tides could be higher than normal’ may be included in Tropical Cyclone Advices but no Storm Tide Warnings issued.
- 3.15 If a total water level above HAT is expected a Storm Tide Warning is issued to disaster management authorities before a qualitative description of the storm tide threat is given in Tropical Cyclone Advices.
- 3.16 Storm Tide Warning Graphics will be issued for key locations in conjunction with the Storm Tide Warning to assist with interpretation of the Storm Tide Warning. Refer to Figure 6 and to paragraphs 3.27 to 3.30 for further details. **The Storm Tide Warning graphics are available via the Bureau’s registered user webpage for the SDCC (<http://reg.bom.gov.au/reguser/>, username and password are available to emergency management officials from the SDCC Watchdesk).**
- 3.17 Evacuation advice should be based on the official Storm Tide Warnings and associated Storm Tide Warning Graphics. **Any other graphical or mapping products derived directly from surge model outputs may not have had the same quality control applied and are to be treated with caution.**
- 3.18 A sample Storm Tide Warning is shown in Figure 7.



Community Threat	
Warning Zone Gales within 24 hours	Watch Zone Gales from 24-48 hours

Past Cyclone Details	Current Cyclone Details	Forecast Cyclone Details (Up to 72 hours from time of issue)
Past Location and Intensity Number Past Track and Movement	Current Location and Intensity Number Very Destructive Winds Destructive Winds Strong Gale Force Winds	Forecast Location and Intensity Number Very Destructive Wind Boundary Destructive Wind Boundary Strong Gale Force Wind Boundary Most Likely Future Track Range of Likely Tracks of Cyclone Centre

The forecast path shown above is the Bureau's best estimate of the cyclone's future movement and intensity. There is always some uncertainty associated with tropical cyclone forecasting and the grey zone indicates the range of likely tracks of the cyclone centre.

Due to the uncertainty in the future movement, the indicated winds will almost certainly extend to regions outside the rings on this map. The extent of the warning and watch zones reflects this.

This product is designed for land-based communities; mariners should read the coastal waters and high seas warnings.

**Figure 4: Sample Tropical Cyclone Forecast Track Map**



## Standard Emergency Warning Signal (SEWS<sup>2</sup>)

- 3.19 The STANDARD EMERGENCY WARNING SIGNAL (SEWS) alerts the community to the broadcast of an urgent safety message relating to a major disaster or emergency. SEWS will be heard:
- if destructive wind gusts (greater than 125 km/h) are expected on the coast or islands during the following 12 hours;
  - if a storm tide greater than 0.5 metres above HAT is expected in the forecast track scenario; and/or
  - the evacuation of a significant number of people has been authorised during a Disaster Situation.

## Technical considerations and local effects

- 3.20 The storm tide height given in official warnings is based on calculation of the open coast storm tide with appropriate allowance made for: (a) amplification in large bays and estuaries; (b) wave action; and (c) where possible, river flooding.
- 3.21 The possible increase of the storm tide in smaller bays and estuaries, and the effect of local flooding, will generally not be included in the storm tide height estimate because of inadequate information on what the impacts might be in particular cases.
- 3.22 Because the height of the storm tide depends upon the intensity of the cyclone, its forward velocity and the time and place of landfall, errors in estimating any of these parameters may result in errors in the forecast storm tide height.
- 3.23 The height of the storm tide is very much dependent on the phase of the astronomical tide and therefore on the time of landfall of the cyclone. In Queensland, tides are mainly semi-diurnal and tidal range can be quite large. This tidal range means a difference of a few hours in time of landfall can have a major influence on the storm tide height.
- 3.24 The accuracy of the forecast time of landfall is usually the most significant uncertainty, and may vary by as much as 6 hours when a cyclone centre is still 12 to 24 hours from the coastline. To provide a realistic safety margin, the Bureau provides storm tide predictions based on both the 'worst case' scenario and 'forecast track' scenario. If possible, the forecast storm tide height is refined with every issue of the Tropical Cyclone Advice.
- 3.25 Individual waves associated with the cyclone may run up the foreshore slope to levels well above the mean waterline. This swash 'wave run-up' depends on the wave height, wave period, beach slope and the nature of the foreshore and can locally increase water levels periodically by up to several metres near the shoreline above the storm tide level.
- 3.26 Storm tides will penetrate the coast to different extents in different locations depending on the depth of inundation; the obstruction to flow by buildings; and vegetation and other factors. Storm Tide Emergency Response Maps (e.g. those produced under the National Storm Tide Mapping Model project) assume the storm tide water level remains horizontal. Of particular concern is the damage potential of both wave action and a significant backwash as the water retreats. Channelling of seawater through canal developments may further exaggerate the impact. Shoaling of navigational channels may impede vessel traffic and hamper harbour operations.

<sup>2</sup> QFES are working on the review of disaster management guidelines in line with government priorities. This includes SEWS.

# Storm Tide Warning - Response System

**Storm Tide = Storm Surge + Normal Tide + Wave Setup**

Although the warning issue timeline is based on the forecast onset of 100 km/h wind gusts, a more flexible approach is adopted in practice to avoid conducting directed evacuations at night.

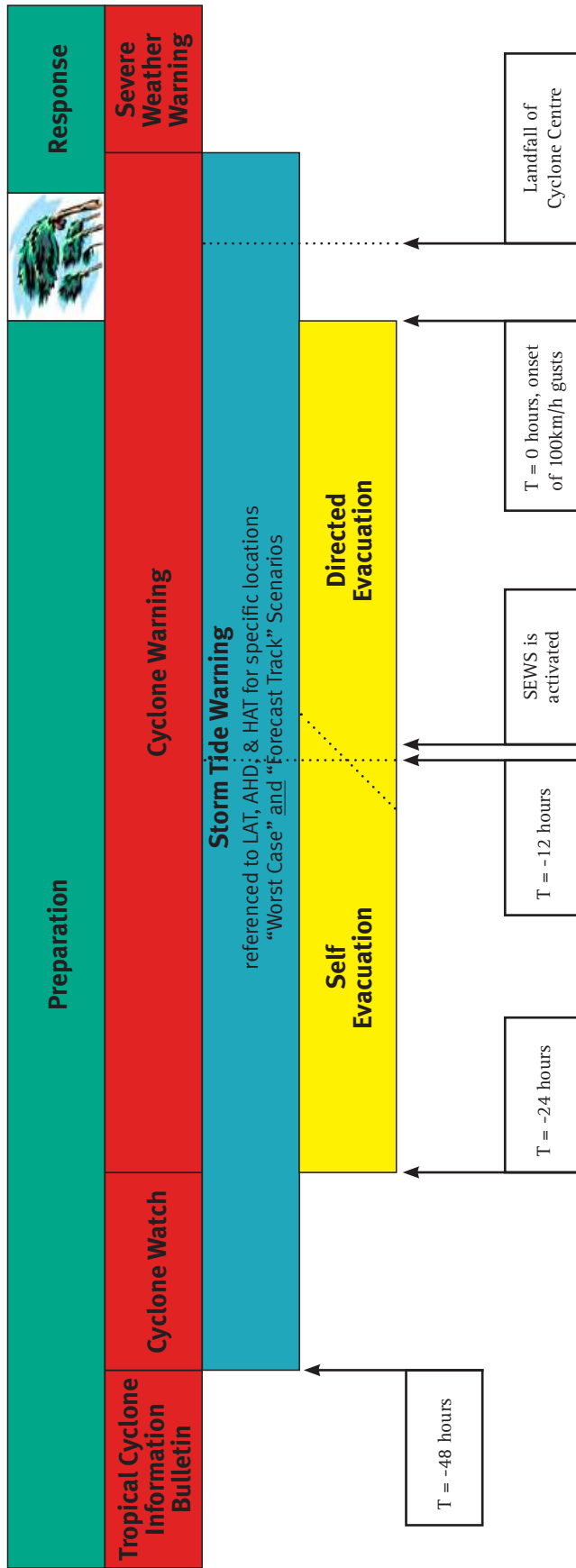
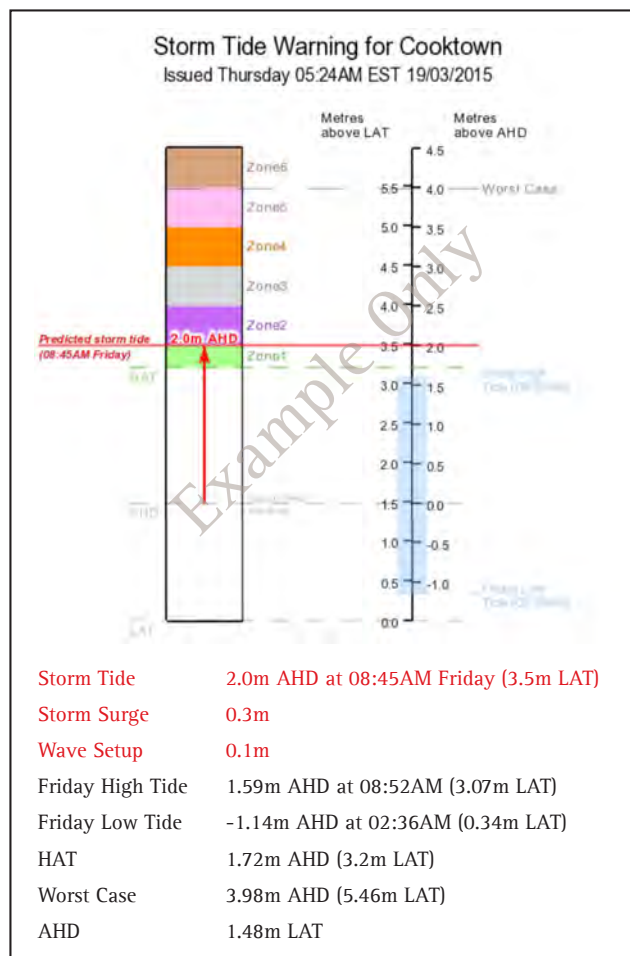


Figure 5: Storm Tide Warning Response System Timeline

## Storm Tide Warning Graphic

- 3.27 The Storm Tide Warning Graphic pictorially summarises the various seawater level heights given in the Storm Tide Warning text for a particular location. The warning heights are always referenced to LAT, AHD and HAT. The graphic includes a height scale referenced to both AHD and Lowest Astronomical Tide (LAT) (on the right and left sides of the scale-bar respectively). A table accompanying the graphic also lists the key heights in AHD and LAT. Note that the graphical product is for a single site only that is chosen from a list of suitable sites on a relative risk basis (see Appendix D for the complete list of potential sites).
- 3.28 A new graphical product will be issued with each text Storm Tide Warning.
- 3.29 The example zones in Figure 6 relate to the National Storm Tide Mapping Model. Many councils have implemented the Queensland Evacuation Guidelines<sup>3</sup> which incorporate different zones to the national model. The Bureau of Meteorology will endeavour to update these graphics to reflect zones adopted by councils in the future.
- 3.30 The graphical product is accessible via a registered user web page, which is hosted by the Bureau at <http://reg.bom.gov.au/reguser/>. The user ID and password are available to agencies involved in disaster management by contacting the State Disaster Coordination Centre (SDCC) by email [sdcc@qfes.qld.gov.au](mailto:sdcc@qfes.qld.gov.au). The product will appear in the graphical storm tide warning section and the links will only be active when a warning is current.



**Figure 6: Sample Storm Tide Warning Graphic**

<sup>3</sup> QFES are working on the review of disaster management guidelines in line with government priorities.

## An example of a Storm Tide Warning

### Storm Tide Warning

Issued at 5:24 am EST on Thursday 19 March 2015.

**NOT FOR DIRECT RELEASE TO THE MEDIA OR THE GENERAL COMMUNITY FOR URGENT ATTENTION**

- State Disaster Coordination Centre (SDCC)
- District Disaster Coordinators at: CAIRNS
- Local Government Offices in the threatened zone

#### FOR INFORMATION

- Police Communications Centre Brisbane
- QFES Regional Directors in the threatened zone

#### SITUATION

Severe Tropical Cyclone *Noname*, category 3, is moving westwards towards the coast. The system is expected to develop into a category 4 system during Thursday and cross the coast between Cape Melville and Cape Tribulation on Friday morning. The worst case scenarios allow for the cyclone to intensify slightly more than expected, and slow down, such that the landfall is closer to or on Friday morning's high tide. Worst case predictions for locations south of Cooktown assume a crossing well to the north but inside the grey zone indicated on the forecast track map. In all cases the highest water level is expected to occur with Friday morning's high tide rather than at coastal crossing time.

#### STORM TIDE: WORST CASE SCENARIO

Location	Tide (m above LAT)	Storm Surge	Wave Setup	Storm Tide (m above LAT)	Storm Tide (m above AHD)	Storm Tide (m above HAT)
Cooktown	3.0m 8:52 AM 20 Mar	2.0	0.5	5.5	4.0	2.3
Port Douglas	3.2m 8:55 AM 20 Mar	1.2	0.3	4.7	3.2	1.4
Cairns	3.3m 9:05 AM 20 Mar	0.9	0.3	4.5	2.9	1.0

#### STORM TIDE: FORECAST TRACK SCENARIO

Location	Tide (m above LAT)	Storm Surge	Wave Setup	Storm Tide (m above LAT)	Storm Tide (m above AHD)	Storm Tide (m above HAT)
Cooktown	3.0m 8:45 AM 20 Mar	0.3	0.2	3.5	2.0	0.3
Port Douglas	3.2m 8:55 AM 20 Mar	0.2	0.2	3.6	2.0	0.2
Cairns	3.3m 9:00 AM 20 Mar	0.2	0.1	3.6	2.0	0.1

#### Notes:

1. The “Worst Case Scenario” storm tide heights are based on the locations in question experiencing a combination of conditions, within the bounds of forecast uncertainty, to produce a larger storm tide from a slightly more intense cyclone with a centre within the range of possibilities as depicted by the grey area on the most recent TC Forecast Track Map. Generally this would mean the cyclone impacting close to the location, such that it experiences maximum onshore winds at a time near to or at the local high tide. The storm surge and storm tide figures presented in this table generally do not represent the most likely outcome, which is represented by the “Forecast Track Scenario”.
2. The contribution due to wave set-up has been included. Storm tide = normal tide + storm surge + wave setup.
3. The additional contribution due to wave run-up has not been included. See para 3.25 of the Handbook.
4. LAT is the Lowest Astronomical Tide (published tide tables use this reference datum)
5. HAT is the Highest Astronomical Tide
6. AHD is the Australian Height Datum

#### ONSET OF DAMAGING WINDS

Wind gusts expected to exceed 100 kilometres per hour are expected at:

Location	Earliest Onset Time (local)	Forecast Track Onset Time (local)
Cooktown	19 Mar 2:00 PM	19 Mar 8:00 PM
Port Douglas	19 Mar 5:00 PM	19 Mar 10:00 PM
Cairns	20 Mar 3:00 AM	Not expected

#### OBSERVED TIDES

See - [www.qld.gov.au/tides](http://www.qld.gov.au/tides)

The next Storm Tide Warning will be issued by 9am EST Thursday 19 March 2015.

Further details are available from the following sources:

1. Tropical Cyclone forecasts and warnings  
QFES Meteorologist - Telephone (07) 3635 xxxx / (07) 3239 xxxx  
Bureau of Meteorology - Telephone (07) 3239 xxxx
2. Technical aspects of the Storm Tide  
SDCC(DSITI) - Telephone 04xx xxx xxx

Telephone numbers are restricted to official use only.

Further information on technical considerations and local effects can be found in the Tropical Cyclone Storm Tide.

Warning - Response System Handbook at <http://disaster.qld.gov.au/Disaster-Resources/Documents/Storm-Tide-Handbook.pdf>.

Figure 7: an example of a Storm Tide Warning



## 4. Disaster Management Response

### Overview

- 4.1 Distribution of the Bureau Storm Tide Warnings is restricted to disaster management authorities. The storm tide warning will indicate the coastal zones, which may be affected, the approximate time of occurrence of the Storm Tide, and the estimated storm tide height above each of LAT, AHD and HAT.
- 4.2 Based on the information provided in the Storm Tide Warnings, consideration may be given to directed evacuation<sup>4</sup> as an option if it is reasonably likely that the event may pose a threat to human life or risk of illness or injury. In these situations persons may also decide to self evacuate<sup>5</sup>.
- 4.3 A Local Disaster Coordinator (LDC), after consultation with the District Disaster Coordinator (DDC), may advise people in threatened areas to undertake a voluntary evacuation while consideration is being given to whether directed evacuation is required. A Voluntary Evacuation Advice is distributed through the media without the SEWS. The option of voluntary evacuation must be included in local evacuation plans.
- 4.4 A directed evacuation under the *Disaster Management Act 2003*, is conducted using empowerments provided by a disaster situation declaration under *the Act*. A DDC may declare a disaster situation if satisfied that the requirements of section 64 of *the Act* have been met. The declaration of a disaster situation requires the approval of the Minister responsible for Police, Fire and Emergency Services, and must be made in accordance with section 65 of *the Act*. During a disaster situation, the DDC and Declared Disaster Officers (DDOs) are provided with additional powers under sections 77-78 of *the Act*. These powers may be required to give effect to a directed evacuation. An LDC, as part of the LDMG, may make a recommendation to a DDC that a directed evacuation is required based on their situational awareness in the preparation for an imminent disaster. However, as the LDMG/LDC has no legislative power to effect a directed evacuation, the responsibility for authorising a directed evacuation remains with the DDC.
- 4.5 The declaration of a disaster situation will provide the DDC and DDOs with the necessary powers to effect a directed evacuation. If this measure is required, the DDC is to keep the QDMC informed, through sitreps to the SDCC, of areas evacuated and areas likely to be evacuated.
- 4.6 Once a declaration of a disaster situation has been made the DDC or DDO may direct persons to evacuate (a directed evacuation) from the declared area. In conducting directed evacuations, the DDC or DDOs may require persons to give them reasonable help in conducting evacuations. This may include persons from the Local Group including the State Emergency Service (SES).
- 4.7 TCWC Senior Forecasters and DSITI Storm Tide Advisers will be available for consultation. DDCs and LDCs can dial the access numbers provided in the Storm Tide Warnings.
- 4.8 For further information on evacuation planning consult the Queensland Evacuation Guidelines for Disaster Management Groups available at [http://www.disaster.qld.gov.au/Disaster-Resources/Documents/2907EMQ\\_SDMG\\_QLD\\_Evac%20Guide\\_web.pdf](http://www.disaster.qld.gov.au/Disaster-Resources/Documents/2907EMQ_SDMG_QLD_Evac%20Guide_web.pdf)
- 4.9 For further information on functions, roles and responsibilities of disaster coordinators across the QDMA see the *Disaster Management Act 2003* and the SDMP.

<sup>4</sup> Directed Evacuation: The planned movement of persons from an unsafe or potentially unsafe location to a safer location and their eventual return.

<sup>5</sup> Self Evacuation: Individuals proactively make their own decision to evacuate prior to any direction from authorities.

## Queensland Evacuation Guidelines<sup>6</sup>

- 4.10 The Queensland Evacuation Guidelines are based on agreed emergency management principles and reflects an all hazards approach to evacuation within Queensland. The aim of the document is to assist disaster management groups during the planning and implementation of the evacuation process within Queensland.
- 4.11 Some important considerations when devising local evacuation plans for storm tide include:
- **Accuracy of predictions:** In the early stages of a storm tide event, storm tide estimates are a rough approximation due to the limitations of the science behind predicting these events. As the cyclone moves closer to the coast, it is possible to obtain a higher degree of precision in predicting the storm tide. As the forecast accuracy increases, the time available to evacuate diminishes rapidly.
  - **Time available:** Any evacuation should be completed before wind conditions prohibit outside movement (i.e. regular wind gusts to 100 kilometres per hour). For planning purposes, the winds reaching this threshold are most likely to occur 3 to 12 hours before the cyclone centre crosses the coast, though earlier onsets are possible depending on the size and speed of the cyclone. For a particular cyclone, the outer ellipse on Tropical Cyclone Track Maps shows the distance of 100 kilometre per hour wind gusts from coastal centres.
  - **Associated Flooding:** Coincidental river flooding may increase the height and extent of tidal penetration in some localities.
- 4.12 LDMGs should ensure local communities are prepared through providing evacuation maps, with identified evacuation zones so that they can be used to guide evacuations. Local knowledge will aid in determining the evacuation zones.
- 4.13 Low offshore islands may be completely inundated.** The short prediction lead-time for storm tides may eliminate the ability to evacuate such locations in the face of a cyclone. The decision to evacuate such islands should be based on public Tropical Cyclone Warnings rather than Storm Tide Warnings.
- 4.14 The Evacuation Guidelines should be used in conjunction with this Handbook when devising storm tide evacuation zones and arrangements for evacuating communities vulnerable to storm tide.

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<sup>6</sup> QFES are working on the review of disaster management guidelines in line with government priorities.

## Roles during a storm tide response

4.15 The three operational phases of the Storm Tide Warning System include:

- Initial Storm Tide Warning;
- Subsequent Storm Tide Warnings;
- Final Storm Tide Warning.

4.16 The operational roles required from various entities and positions during these stages are detailed below.

### State Disaster Coordination Centre

#### Initial Storm Tide Warning

- The QFES Watch Desk to liaise with and alert the SDC (when appointed), Executive Director, QFES Operations Branch, Director, Disaster Management Services Unit, Executive Manager and DSITI representative, that a Storm Tide Warning has been issued and recommend required actions.
- The QFES Watch Desk to alert affected DDCs and affected QFES Regional Directors in cyclone watch and warning zones, as required.
- Alert Minister, QDMC and SDCG members.
- Contact DSITI to have a Storm Tide Adviser available.

#### Subsequent Storm Tide Warnings

- Alert SDC and DDCs in the threatened zone and verify receipt.
- Consult with TCWC Senior Forecasters and DSITI Storm Tide Advisers on the DDC's recommendation.
- Provide advice to feed into the DDC's recommendation
- Notify DDC, QFES Regional Directors, Police Communications Centres, TCWC and DSITI of the decision reached.
- Relay the Minister's written approval to the DDC so a Disaster Situation can be declared. In the case of a verbal declaration, QPS would confirm and organise the formal written approval and QFES CLLO to arrange gazetting as soon as practical.
- Receive evacuation progress reports from the DDC.

#### Final Storm Tide Warning

- Advise SDC, DDCs and QFES Regional Directors and verify receipt.

## **Chair – District Disaster Management Group**

### **Initial Storm Tide Warning**

- Receive a copy of the warning from both the Bureau and the SDCC.
- Confirm receipt of warning to SDCC.
- Review district disaster plans.
- Alert and liaise with DDMG members and prepare to stand-up DDCC.
- Alert and liaise with the relevant LDC(s).
- If appropriate, liaise with the SDC (if appointed) and SDCC for any strategic advice from QDMC on disaster response operations.
- Seek the Minister's approval to declare a Disaster Situation, verbally if the situation warrants (see 4.4 of this Handbook).

### **Subsequent Storm Tide Warnings**

- Receive a copy of the warning from both the Bureau and the SDCC.
- Confirm receipt of warning to SDCC.
- Alert relevant LDC(s) of warning.
- Convene a meeting of the DDMG and consult with the engineer, other advisers and LDC(s) on the need for evacuation.
- Liaise with the LDC regarding the issue of Voluntary Evacuation Advice (without releasing SEWS), for specific high risk areas.
- Liaise with, and seek advice from, the QDMC through the SDC (if appointed) and SDCC regarding planned evacuations and inform of areas already evacuated.
- Make preliminary arrangements with the local media to broadcast a 'Directed evacuation' (with SEWS) to the public, in accordance with the Local Evacuation Plan.
- Receive approval to declare a Disaster Situation from the Minister and/or the District Disaster Coordinator, and notify LDC(s) when to proceed with directed evacuation of specific areas.
- Issue an Directed Evacuation Order – and update as necessary.

### **Final Storm Tide Warning**

- Receive a copy of the final storm tide warning from both Bureau and the SDCC.
- Confirm receipt of warning to SDCC.
- Alert and liaise with the relevant LDC(s) regarding the final warning.
- Issue a Media Bulletin which may include information on the transition to recovery.

## **Local Disaster Coordinator**

### **Initial Storm Tide Warning**

- Receive a copy of the warning from the Bureau.
- Review relevant disaster plans including the local evacuation plan.
- Liaise with DDC regarding specific high risk areas that may need voluntary evacuation, as detailed in the local evacuation plan.
- Advise LDMG members, consulting engineer and other advisers.
- Activate local evacuation plan.

### **Subsequent Storm Tide Warnings**

- Receive a copy of the warning from the Bureau.
- Liaise with the Chair of the LDMG and convene a meeting.
- Liaise with the consulting engineer to local government and other advisers on the need for evacuation.
- Liaise, if necessary, with the TCWC Senior Forecasters and DSITI Storm Tide Advisers.
- Advise DDC of recommendations for evacuations.
- Receive DDC notification to proceed with Directed evacuation of specific areas.
- Release local evacuation information to public.
- Keep DDC informed of evacuation progress.

### **Final Storm Tide Warning**

- Receive a copy of the warning from the Bureau.



## 5. Emergency Response Maps

- 5.1 It is essential that all authorities engaged in disaster management activities have maps that are relevant to their area of responsibility.
- 5.2 Most local authorities at risk from storm tide inundation now operate geographic information systems (GIS) in which data on roads, properties and lifeline infrastructure are held digitally. The data available in these information systems is ideal for use in all aspects of disaster management. Many of these systems also contain very detailed digital elevation model (DEM) data (i.e. topographic). This data is typically far more accurate and detailed than traditional mapping products. For example, 0.25 metre elevation contours referenced to the Australian Height Datum (AHD) are available for the majority of coastal communities. These DEMs are
- 5.3 The Protecting our Coastal Communities Project (POCC) acquired high resolution elevation data over coastal communities. This data was captured for majority of coastal communities and is available to local governments and other state government agencies through the Department of Natural Resources and Mines (DNRM). A link to a map showing latest elevation data coverage is available through the DNRM website: [https://www.dnrm.qld.gov.au/\\_data/assets/pdf\\_file/0003/109344/lidar-capture-projects.pdf](https://www.dnrm.qld.gov.au/_data/assets/pdf_file/0003/109344/lidar-capture-projects.pdf).
- 5.4 Storm tide maps throughout Australia have been produced to a variety of standards and the Queensland Tropical Cyclone Consultative Committee (QTCCC)<sup>7</sup> identified this factor as a potential risk during disaster management operations, particularly where cyclones are likely to affect multiple jurisdictions simultaneously.
- 5.5 To assist evacuation planning the POCC project has published elevation zones in half metre increments from HAT up to an extreme event. These zones are an indication of potential storm tide inundation for particular events using the bath tub approach. Please be aware that this approach assumes water levels remain horizontal and for many communities local government may have better information based on detailed modelling techniques. The information provided by POCC is available via an interactive mapping site from the Public Sector Business Agency ‘Situational Awareness Map’ portal (SAM) (<http://mapping.psba.qld.gov.au/hath5/>, username and password required).
- 5.6 The Total Operational Mapping system (TOM) currently available to the SDCC should and is recognised as the “situational awareness” tool for the SDCC and DDCCs (*State Disaster Coordination Centre: Room for Improvement Strategy Report June 2014*). The Public Safety Business Agency (PSBA) is responsible for providing mapping services to the SDCC during operations to support the SDCC and QDMC decision making (*2015 State Disaster Management Plan, Role and Responsibility Table, Public Safety Business Agency, p44*). As an application TOM is a web-based mapping application that uses the GeoCortex Essentials (Silverlight) technology to allow users to view and interact with spatial information in an easy-to-use interface. It is a visualisation tool used for planning and situational awareness before and during emergency events. TOM contributes to delivering a Common Operating Picture (COP) where all users are able to access a consistent,

<sup>7</sup> The QTCCC is a joint initiative between the Queensland Fire and Emergency Services and the Queensland Regional Office of the Australian Bureau of Meteorology. The Committee provides a means of reviewing tropical cyclone information from a variety of sources and recommending practical measures for cyclone impact reduction in Queensland.

## 6. Appendices

### Appendix A - Tidal Planes

Extracted from *The Queensland Tide Tables*.

Online at <http://www.msq.qld.gov.au/Tides.aspx>.

The form of the tide changes along the Queensland coast. For places south from Lindeman Island (latitude 20 degrees 28 minutes south) refer to the section semidiurnal tidal planes. For places in the Torres Strait and the Gulf of Carpentaria refer to the diurnal tidal planes section. When seeking information for places between Lindeman and Torres Strait where the classification may be either semidiurnal or diurnal it is necessary to refer to both the semidiurnal and diurnal tables.

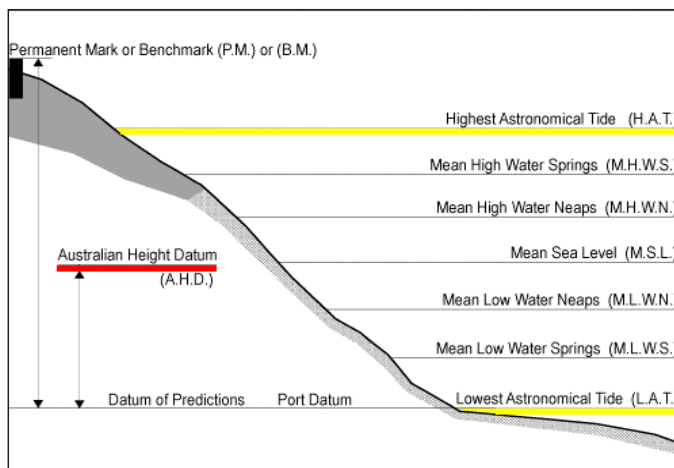


Figure 8a: Semidiurnal tidal planes

#### *Semidiurnal tidal planes*

The term ‘semidiurnal’ refers to a tide which has a period or cycle of approximately half of one tidal day (about 12.5 hours). Semidiurnal tides usually have two high and two low tides each day. The tides at Brisbane Bar are a typical example of semidiurnal tides.

#### *Diurnal tidal planes*

The term ‘diurnal’ refers to a tide which has a period or cycle of approximately one tidal day (about 25 hours). Diurnal tides usually have one high and one low tide each day. The tides at Karumba are a typical example of diurnal tides.

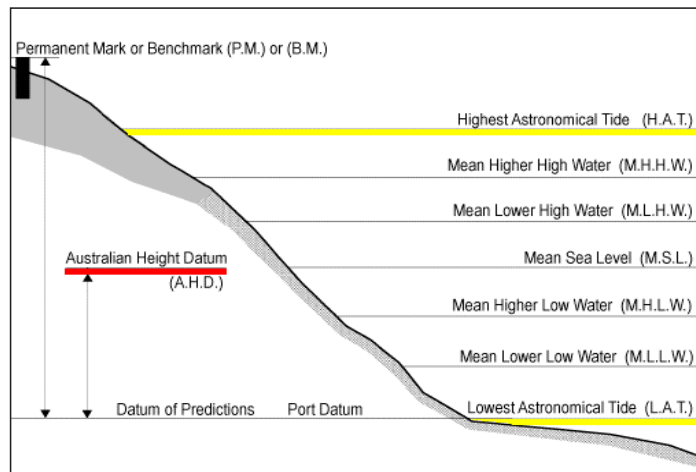


Figure 8b: Diurnal tidal planes

## Appendix B - Storm Tide Gauge Network

DSITI operates a network of storm tide gauges along the Queensland coastline. Information from these gauges is provided on the DSITI's storm tide web pages at: <http://www.qld.gov.au/tides>.

The Bureau uses the data to enhance its predictions whilst DSITI advises the State Group on seawater levels, storm tide inundation and probable impacts on evacuation procedures. On request, DSITI will provide advice to relevant DDCs, Local Groups and their specialist engineers.



Figure 9: DSITI Storm Tide Gauge Network and Wave Buoy Locations

### Access to Information on Cyclones and Storm Surge

**Telephone** 1300 659 212  
(for recorded public Tropical Cyclone Advises with state-wide access for the cost of a local call)

**Web** <http://www.bom.gov.au/cyclone> (Tropical Cyclone Advises and Track Maps)  
<http://www.qld.gov.au/tides> (DSITI storm tide web pages)  
<http://www.qld.gov.au/waves> (DSITI wave monitoring web pages)

## Appendix C - Tropical Cyclone Warning Service

**Tropical Cyclone Outlooks** - are issued daily during the cyclone season and give the likelihood of a tropical cyclone developing in the Eastern region (Coral Sea) and Northern region (including the Gulf of Carpentaria) in the following 3 days.

**Tropical Cyclone Information Bulletins** - are issued every 6 hours when a cyclone exists in Queensland waters, or when a low threatens to develop into a cyclone.

**Tropical Cyclone Technical Bulletins** - are issued every 6 hours when a cyclone exists in Queensland waters, or when a low threatens to develop into a cyclone. These are in text format and provide forecast track positions extending out to 120 hours (these will be available to the public on the Bureau's web site).

**Tropical Cyclone Advices** - are messages referring to specific cyclone threats. These messages are sequentially numbered from 1 upwards for each cyclone.

Tropical Cyclone Advices contain messages detailing 2 levels of threat to coastal and island communities, namely Cyclone Watch and Cyclone Warning.

- Cyclone Watch - this message will be issued for localities where a cyclone centre is expected to make landfall and/or wind gusts of 100 kilometres an hour or more are likely within the next 1-2 days.
- Cyclone Warning - this message will be issued for localities where a cyclone centre is expected to make landfall and/or wind gusts of 100 kilometres an hour or more are likely within the next 24 hours.

**Tropical Cyclone Advices** are issued 6-hourly when the threat is more than 24 hours away from the coast and islands, increasing to 3 hourly and then hourly as the urgency of the messages increases. Hourly updates may be issued for Category 2 (or greater) cyclones. The Bureau of Meteorology aims to dispatch Advices at least 10 minutes before the hour they are due so that the media can broadcast them close to the hour.

Each Cyclone Warning will commence with a headline statement designed to summarise the essence of the message. It will cover the area threatened and the level and timing of the threat.

**Severe weather warnings** - are issued (generally after landfall) when the system is no longer a cyclone but severe weather and/or flooding rains are still being experienced.

### Cyclone Category Scale

The system rates cyclones from 1 to 5, with 1 being relatively weak cyclones and 5 the most intense. **Category 3, 4 and 5 cyclones are severe with very destructive winds near the centre.**

Category	Wind Gusts (km/h)	Potential Damage
1	90–125	Minimal
2	125–165	Moderate
3	165–225	Major
4	225–280	Devastating
5	> 280	Extreme

## Standard Emergency Warning Signal<sup>8</sup>

In the case of tropical cyclones, use of the Standard Emergency Warning Signal (SEWS) will be limited to those warnings where **destructive winds are expected on the coast or islands in the next 12 hours and/or a damaging Storm Surge is predicted**. Authorisation for the electronic media to use the signal will be contained near the top of the Tropical Cyclone Advice. The SEWS may also be used very infrequently for other serious and large-scale weather and flood events.

Networking stations have been asked to pay particular attention to the **isolation of transmitters** so that undue alarm is not created by transmission of the signal into areas that are not seriously threatened. It may not always be possible however to totally confine the transmissions.

<sup>8</sup> QFES is currently reviewing the SEWS Guideline.

## Tropical Cyclone Forecast Track Map

The Tropical Cyclone Forecast Track Map (see sample at Figure 4) includes both the past track and the forecast positions and intensities in 6-hourly time-steps out to 72 hours. It is important to note however that this product does not contain all the information in the Tropical Cyclone Advice, especially important details on the cyclone impact, such as the potentially dangerous threat of storm tide. It is also unsuitable for mariners who are advised to refer to coastal waters and ocean wind warnings.

A Tropical Cyclone Technical Bulletin is also available to the public on the Bureau's web site. This will generally include tropical cyclone forecast track positions extending out to 120 hours.

Detailed below are the main features of the Tropical Cyclone Forecast Track Map.

### Forecast Track

- Distinctive colours are used to depict the Watch and Warning zones and the area of very destructive winds (gusts >170 km/h), destructive winds (gusts >125 km/h) and strong gales (gusts >100 km/h).
- The forecast track is the most likely path of the cyclone.
- The past track is shown along with the forecast positions out to 72 hours in 6-hourly time steps.
- The numbers in the circles at the centre locations show the Category, or if the system is expected to significantly weaken, an "L" is used to indicate a low pressure centre.

### Grey Zone of Uncertainty (otherwise known as the Cone of Uncertainty)

- The grey zone is the area within which the cyclone centre is expected to be in the following 72 hours.
- This covers most scenarios but occasionally the cyclone may move outside this area.
- Importantly, the impact of the cyclone will almost certainly extend well beyond the grey zone.

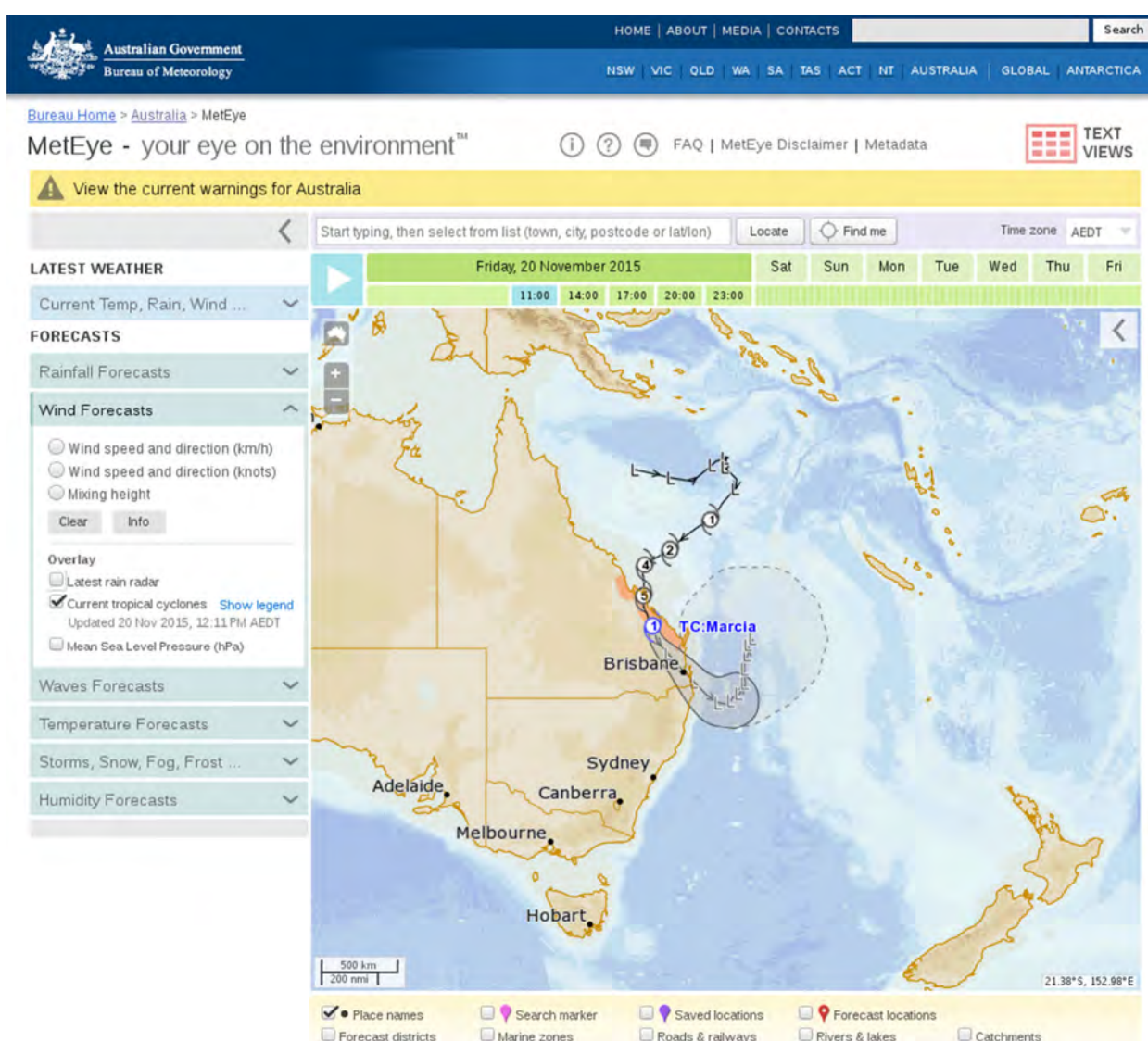
### Wind Thresholds

- Solid coloured ellipses surround the current cyclone position, representing winds of various strengths.
- The open ellipses surrounding the forecast positions represent the outer extent of each category of wind strength, assuming the cyclone follows the official forecast track.
- Note that the ellipses may be omitted from the intermediate forecast positions to minimise clutter.
- The winds are likely to extend beyond these areas as the cyclone will almost certainly not follow the forecast track precisely. The coastal extent of the Warning zone reflects this uncertainty.



## MetEye

- The Tropical Cyclone Forecast Track Map is also available through the MetEye viewer on the Bureau's website (<http://www.bom.gov.au/australia/meteye/>). The past positions and forecast positions to 72 hours ahead are viewable, as well as forecast positions to 120 hours ahead. A sample is shown in Figure 10 below. Grey Zone of Uncertainty (otherwise known as the Cone of Uncertainty)
- The grey zone is the area within which the cyclone centre is expected to be in the following 72 hours.
- This covers most scenarios but occasionally the cyclone may move outside this area.
- Importantly, the impact of the cyclone will almost certainly extend well beyond the grey zone.



**Figure 10: Sample forecast track map showing 72 and 120 hour forecast positions as displayed in the Bureau's Meteye viewer**

## Appendix D - Storm Tide Effects on Coastal Centres and accompanying maps and tables

Centres of habitation on the Queensland coast are listed in the **accompanying Maps and Tables**. These are classified into Disaster Districts comprising a number of local government areas.

- Tropical cyclone warning place names as used by the Bureau are **shaded green** in the following table for easy identification.
- Locations of the Queensland DSITI storm tide gauges have the location **shaded yellow**.
- The locations that the Bureau will provide Storm Tide Warning and Storm Tide Warning Graphics are summarised in Appendix E.

### Example

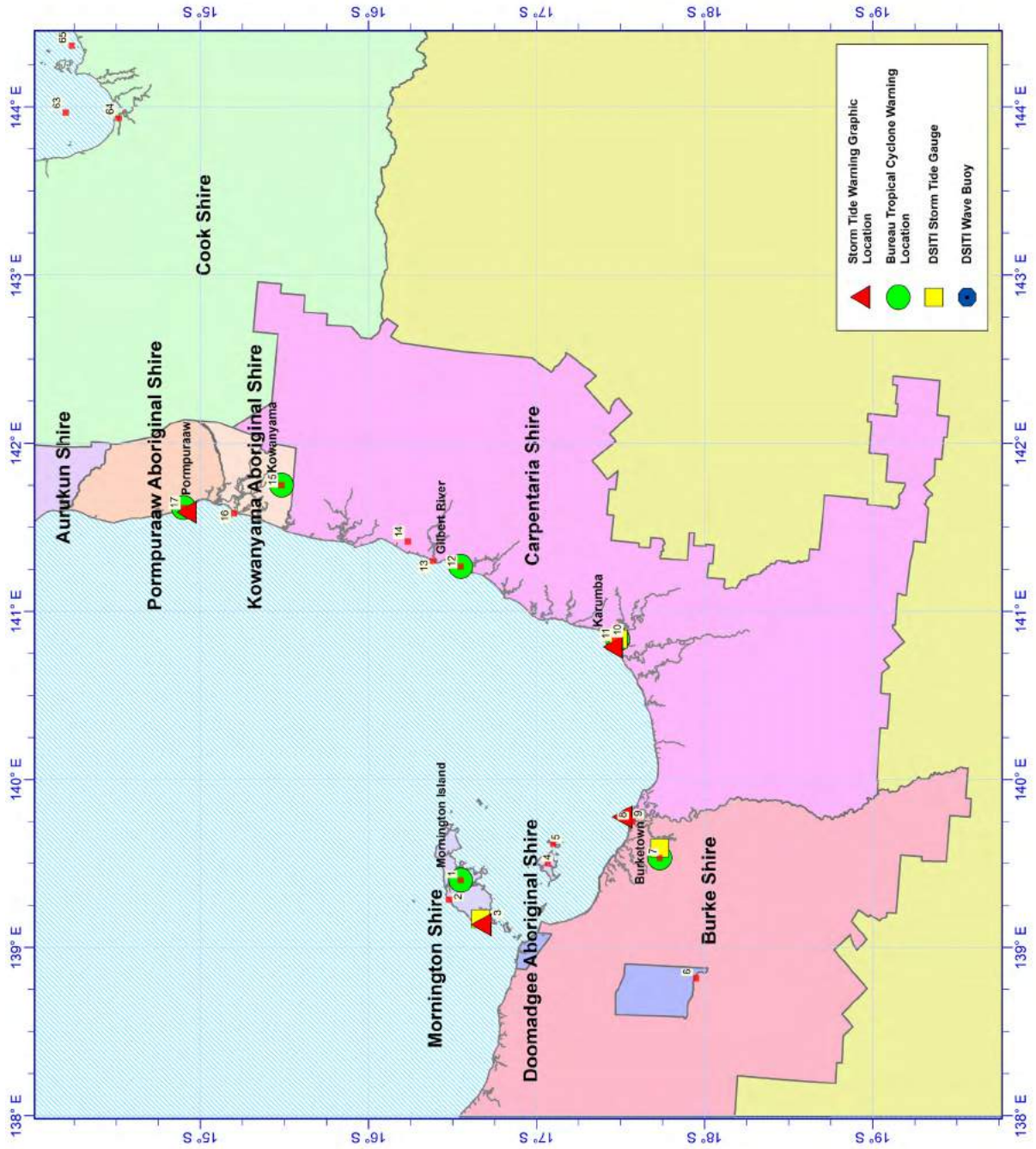
Point	Name	Lat.	Long.	LGA	HAT above AHD	Remarks
174	Townsville	-19.27	146.80	Townsville City	2.25	
175	Pallarenda	-19.20	146.77	Townsville City	2.22	National Storm Tide Map

For each centre the following information is given:

- Highest Astronomical Tide (HAT) above Australian Height Datum (AHD) or Mean Sea Level (MSL)**  
Indicative HAT values are based on points from the NDRP Storm Tide Interpolation Study, 2014
- Remarks**  
Where applicable, comments on whether a National Storm Tide Map is available or details of a previous event exist.

The information presented in the table should be used with caution. It is the best available at the date of printing but is derived from many different sources, hence its complete reliability cannot be guaranteed. Where accuracy of data is of a critical nature, it is recommended that the user refer to its official source for verification.

**Map 1: The Gulf of Carpentaria Coastline**

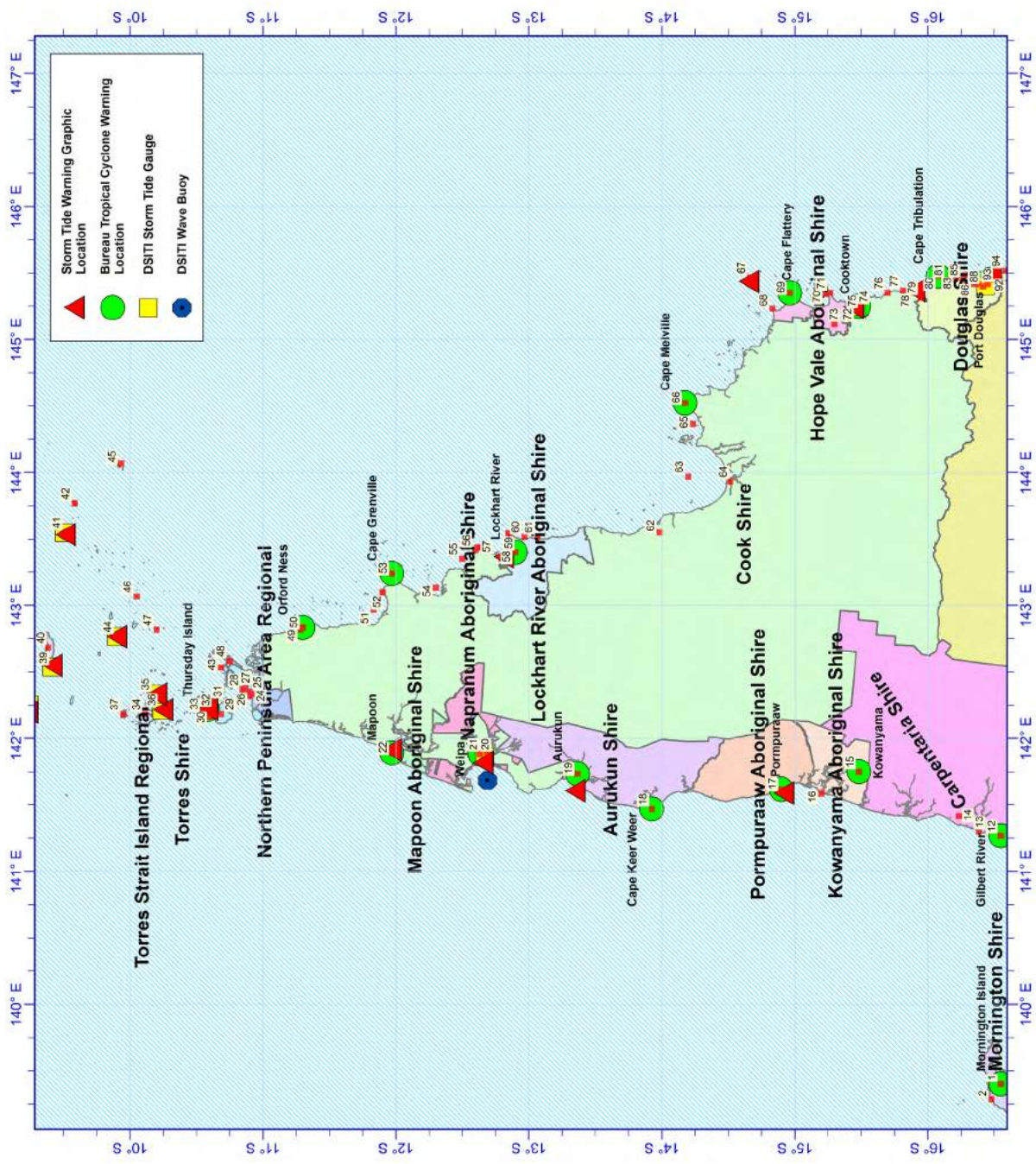


Map 1: The Gulf of Carpentaria Coastline cont.

Point	Name	Lat.	Lon.	LGA	HAT (m) above AHD	Remarks	Date	Event	Reference Central Pressure (hPa)	Storm surge (m)	Storm Tide Level (m) AHD	Inundation Above HAT (m)
1	Mornington Island	-16.54850	139.40115	Mornington	1.98	National Storm Tide Map	19/12/1976	Ted	950	1.7	1.8	
2	Birri Beach	-16.47917	139.28681	Mornington	1.65							
3	Denham Island	-16.71453	139.15979	Mornington	1.98							
4	Bentinck Is	-17.06700	139.50000	Mornington	2.59		23/02/1948		996	3.7	4.7	3.2
5	Sweeters Is (Inscription point)	-17.10225	139.61892	Mornington	2.63							
6	Doomadgee	-17.94434	138.83009	Doomadgee Council	2.80							
7	Burketown	-17.74080	139.54780	Burke	2.80		19/12/1976	Ted	950	3	3.2	
8	Albert River	-17.56700	139.75000	Burke	2.80		19/12/1976	Ted	950	4.6	6.3	3.6
9	Albert River Heads	-17.57300	139.75800	Burke	2.80		05/03/1887			5.5	7.8	5.1
10	Karumba	-17.48386	140.83976	Carpentaria	2.70		19/12/1976	Ted	950	2	3.6	
11	Karumba Point	-17.46501	140.82926	Carpentaria	2.70							
12	Gilbert River	-16.54849	141.26784	Carpentaria	2.32		6/01/1996	Barry	950	4.5	6	3.4
13	Staaten River Offshore	-16.38300	141.30000	Carpentaria	2.28		6/01/1996	Barry	950	3.7		
14	Inkerman Station	-16.23334	141.41667	Carpentaria	2.24		19/02/1971	Fiona	960	>4		
15	Kowanyama	-15.47960	141.74202	Kowanyama Council	2.00							
16	Mitchell River	-15.19849	141.58444	Kowanyama Council	1.94							
17	Pormpuraaw	-14.89794	141.61921	Pormpuraaw Council	1.86	National Storm Tide Map	3/02/1964	Dora	974	5		



Map 2: Cape York Coastline



Map 2: Cape York Coastline cont.

Point	Name	Lat.	Lon.	LGA	HAT (m) above AHD	Remarks	Date	Event	Reference Central Pressure (hPa)	Storm surge (m)	Storm Tide Level (m) AHD	Inundation Above HAT (m)
18	Cape Keer Weer	-13.92651	141.46835	Aurukun Shire Council	1.60							
19	Aurukun	-13.35849	141.72807	Aurukun Shire Council	1.60	National Storm Tide Map	19/02/1971	Fiona	960	0.9		
20	Napranum (Weipa South)	-12.68239	141.88892	Napranum Aboriginal Shire Council	1.63							
21	Weipa	-12.63000	141.87862	Shire Council	1.63		31/12/1978	Peter	980	1.2	2.3	0.6
22	Mapoon	-12.01906	141.90251	Weipa Town	1.63	National Storm Tide Map						
23	Cowal Creek	-10.89850	142.31783	Mapoon Aboriginal Shire Council	1.55							
24	Injinoo	-10.90626	142.32557	Northern Peninsula Area Regional Council	1.55	National Storm Tide Map						
25	Umagico	-10.89267	142.35113	Northern Peninsula Area Regional Council	1.55	National Storm Tide Map						
26	Seisia	-10.84999	142.36809	Northern Peninsula Area Regional Council	1.62							
27	New Mapoon	-10.86627	142.38640	Northern Peninsula Area Regional Council	1.62	National Storm Tide Map						
28	Red Island Point	-10.85000	142.36666	Northern Peninsula Area Regional Council	1.62							
29	Prince Of Wales Island (Muralug)	-10.68449	142.18506	Torres Strait Island Regional Council	1.90							
30	Friday (Gealug) Island	-10.59688	142.16529	Torres Strait Island Regional Council	1.81							
31	Horn (Narupai) Island	-10.60711	142.28418	Torres Strait Island Regional Council	2.09							
32	Thursday Island	-10.58499	142.22058	Torres Strait Island Regional Council	2.03							



Map 2: Cape York Coastline cont.

Point Name	Lat.	Lon.	LGA	HAT (m) above AHD	Remarks	Date	Event	Reference Central Pressure (hPa)	Storm surge (m)	Storm Tide Level (m) AHD	Inundation Above HAT (m)
33 Hammond Island	-10.55433	142.21891	Torres Strait Island Regional Council	2.06							
34 Badu	-10.13238	142.18751	Torres Strait Island Regional Council	1.96							
35 Saint Pauls, Moa Island (Banks Island)	-10.18750	142.33417	Torres Strait Island Regional Council	2.29							
36 Kubin, Moa Island (Banks Island)	-10.23323	142.21917	Torres Strait Island Regional Council	1.78							
37 Mabuiaig Island	-9.95351	142.19223	Torres Strait Island Regional Council	1.99							
38 Boigu Island	-9.23240	142.21862	Torres Strait Island Regional Council	2.76							
39 Dauan Island	-9.41406	142.53946	Torres Strait Island Regional Council	2.09							
40 Saibai Island	-9.38990	142.62002	Torres Strait Island Regional Council	2.03							
41 Stephens Island	-9.50759	143.54528	Torres Strait Island Regional Council	2.09							
42 Darnley Island	-9.58698	143.77055	Torres Strait Island Regional Council	2.28							
43 Yorke (Masig) Island	-10.68355	142.52920	Torres Shire	2.04							
44 Yam Island	-9.90137	142.77501	Torres Strait Island Regional Council	2.14							
45 Murray Island	-9.91641	144.05251	Torres Strait Island Regional Council	1.71							
46 Coconut Island	-10.04862	143.06780	Torres Strait Island Regional Council	2.27							
47 Sue (Warraber) Islet	-10.20750	142.82473	Torres Strait Island Regional Council	2.13							

Map 2: Cape York Coastline cont.

Point Name	Lat.	Lon.	LGA	HAT (m) above AHD	Remarks	Date	Event	Reference Central Pressure (hPa)	Storm surge (m)	Storm Tide Level (m) AHD	Inundation Above HAT (m)
48 Somerset	-10.74084	142.59448	Northern Peninsula Area Regional Council	2.35							
49 Orford Bay	-11.28269	142.81585	Cook Shire Council	2.40							
50 Orford Ness	-11.29878	142.82750	Cook Shire Council	2.40							
51 Shelburne Bay	-11.82687	142.97861	Cook Shire Council	2.35							
52 Round Point	-11.90000	143.10000	Cook Shire Council	2.29							
53 Cape Grenville	-11.96912	143.24249	Cook Shire Council	2.15							
54 Temple Bay	-12.30069	143.13445	Cook Shire Council	2.13							
55 Weymouth Bay	-12.49899	143.34114	Cook Shire Council	1.99							
56 Portland Roads	-12.59474	143.41139	Cook Shire Council	1.87							
57 Cape Weymouth	-12.61268	143.43749	Cook Shire Council	1.87							
58 Lockhart River	-12.78515	143.34311	Lockhart River Council	1.69		10/03/2005	Ingrid				
59 Cape Direction	-12.84187	143.54809	Lockhart River Council	1.56					1.15		
60 Second Red Rocky Point	-12.96669	143.51668	Lockhart River Council	1.57							
61 First Red Rocky Point	-13.06668	143.51667	Lockhart River Council	1.57							
62 Silver Plains	-13.98345	143.54998	Cook Shire Council	1.96							

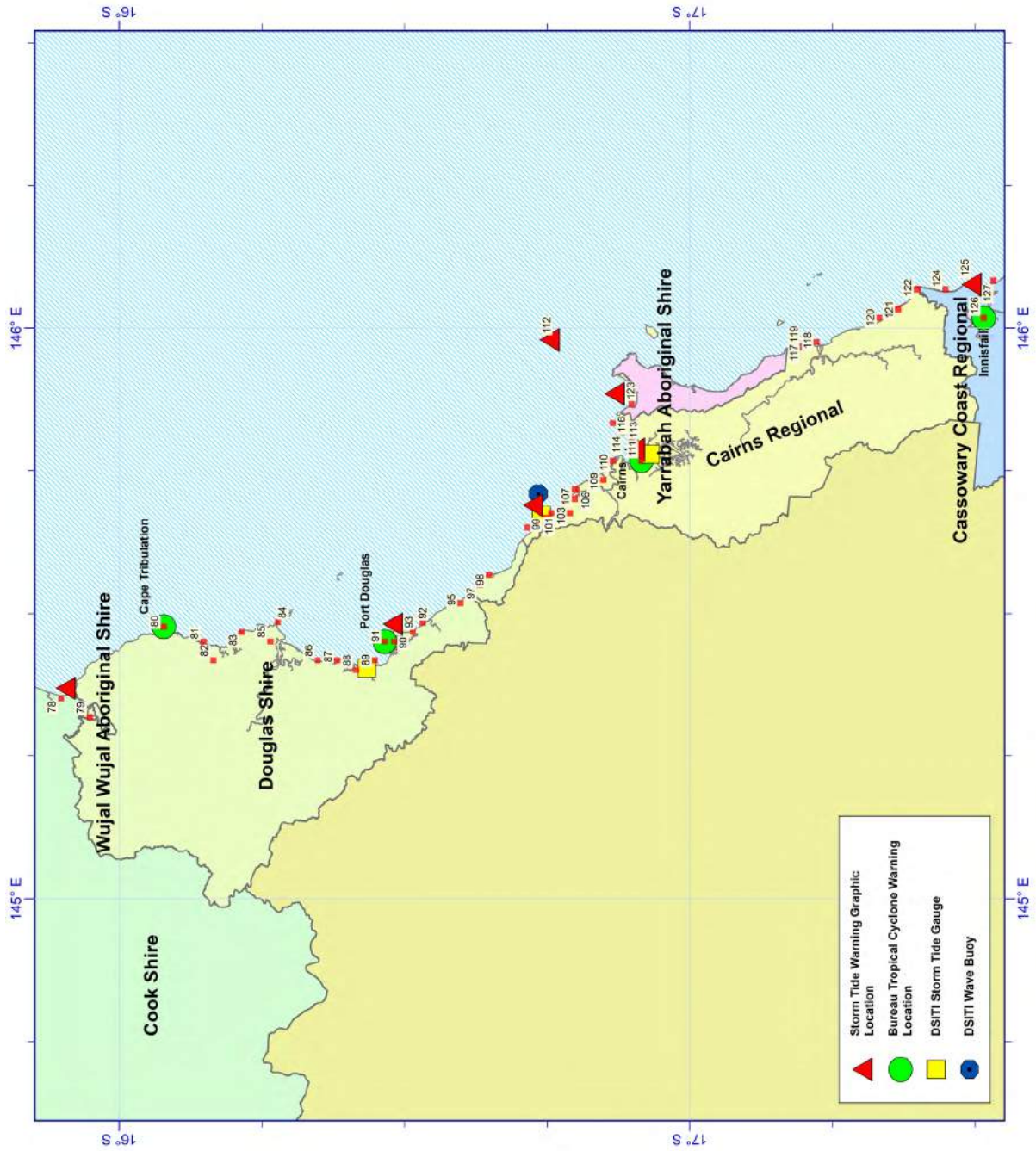
Map 2: Cape York Coastlin cont.

Point Name	Lat.	Lon.	LGA	HAT (m) above AHD	Remarks	Date	Event	Reference Central Pressure (hPa)	Storm surge (m)	Storm Tide Level (m) AHD	Inundation Above HAT (m)
63 Princess Charlotte Bay	-14.21683	143.96805	Cook Shire Council	1.95							
64 Annie River	-14.51518	143.93442	Cook Shire Council	1.95							
65 Bathurst Bay	-14.23598	144.36783	Cook Shire Council	1.78		05/03/1899	Mahina	914	13.7	13	11
66 Cape Melville	-14.17078	144.52304	Cook Shire Council	1.68							
67 Lizard Island	-14.66666	145.46032	Cook Shire Council	1.58							
68 Lookout Point	-14.83195	145.23027	Cook Shire Council	1.59							
69 Cape Flattery	-14.94848	145.34971	Hope Vale Council	1.59		4/03/1973	Madge	997	1		
70 Cape Bedford	-15.22424	145.34226	Hope Vale Council	1.43							
71 South Cape Bedford	-15.27324	145.35778	Hope Vale Council	1.50							
72 Grassy Hill	-15.46085	145.25529	Cook Shire Council	1.72							
73 Hope Vale	-15.29629	145.11196	Hope Vale Council	1.50							
74 Cooktown	-15.47227	145.25224	Cook Shire Council	1.72		4/03/1973	Madge	997	1		
75 Quarantine Bay	-15.49376	145.27888	Cook Shire Council	1.72							
76 Thomas Point	-15.70002	145.35000	Cook Shire Council	1.69							
77 Cedar Bay	-15.81739	145.36779	Cook Shire Council	1.68							

Map 2: Cape York Coastline cont.

Point Name	Lat.	Lon.	LGA	HAT (m) above AHD	Remarks	Date	Event	Reference Central Pressure (hPa)	Storm surge (m)	Storm Tide Level (m) AHD	Inundation Above HAT (m)
78 Ayton	-15,92307	145,35092	Cook Shire Council	1.67							
79 Wujal Wujal	-15,94598	145,31861	Wujal Wujal Council	1.67							

**Map 3: Cairns Coastline**



Map 3: Cairns Coastline cont.

Point Name	Lat.	Lon.	LGA	HAT m above AHD	Remarks	Date	Event	Reference Central Pressure (hPa)	Storm surge (m)	Storm Tide Level (m) AHD	Inundation Above HAT (m)
80 Cape Tribulation	-16.07792	145.47555	Douglas Shire	1.68	National Storm Tide Map						
81 Noah Creek	-16.14847	145.45110	Douglas Shire	1.70			960	0.9			
82 Thornton (Coopers) Beach	-16.17235	145.44055	Douglas Shire	1.70	National Storm Tide Map						
83 Bailey Point	-16.21669	145.46666	Douglas Shire	1.70			980	1.2	2.3	0.6	
84 Cape Kimberley	-16.27875	145.48528	Douglas Shire	1.70							
85 Whitby	-16.26517	145.45110	Douglas Shire	1.70							
86 Wonga	-16.33780	145.41779	Douglas Shire	1.77	National Storm Tide Map						
87 Dayman (Rocky) Point	-16.38181	145.41777	Douglas Shire	1.77							
88 Newell	-16.42736	145.40581	Douglas Shire	1.78	National Storm Tide Map						
89 Cooya Beach	-16.44877	145.40861	Douglas Shire	1.78	National Storm Tide Map						
90 Magazine Island	-16.48367	145.45778	Douglas Shire	1.78							
91 Port Douglas	-16.48348	145.46526	Douglas Shire	1.78	National Storm Tide Map	11/03/1934	968	1.8			
92 Four Mile Beach	-16.51937	145.47335	Douglas Shire	1.74							
93 Craiglie	-16.53871	145.47001	Douglas Shire	1.74	National Storm Tide Map						
94 Pebbly Beach	-16.58293	145.51278	Douglas Shire	1.72							



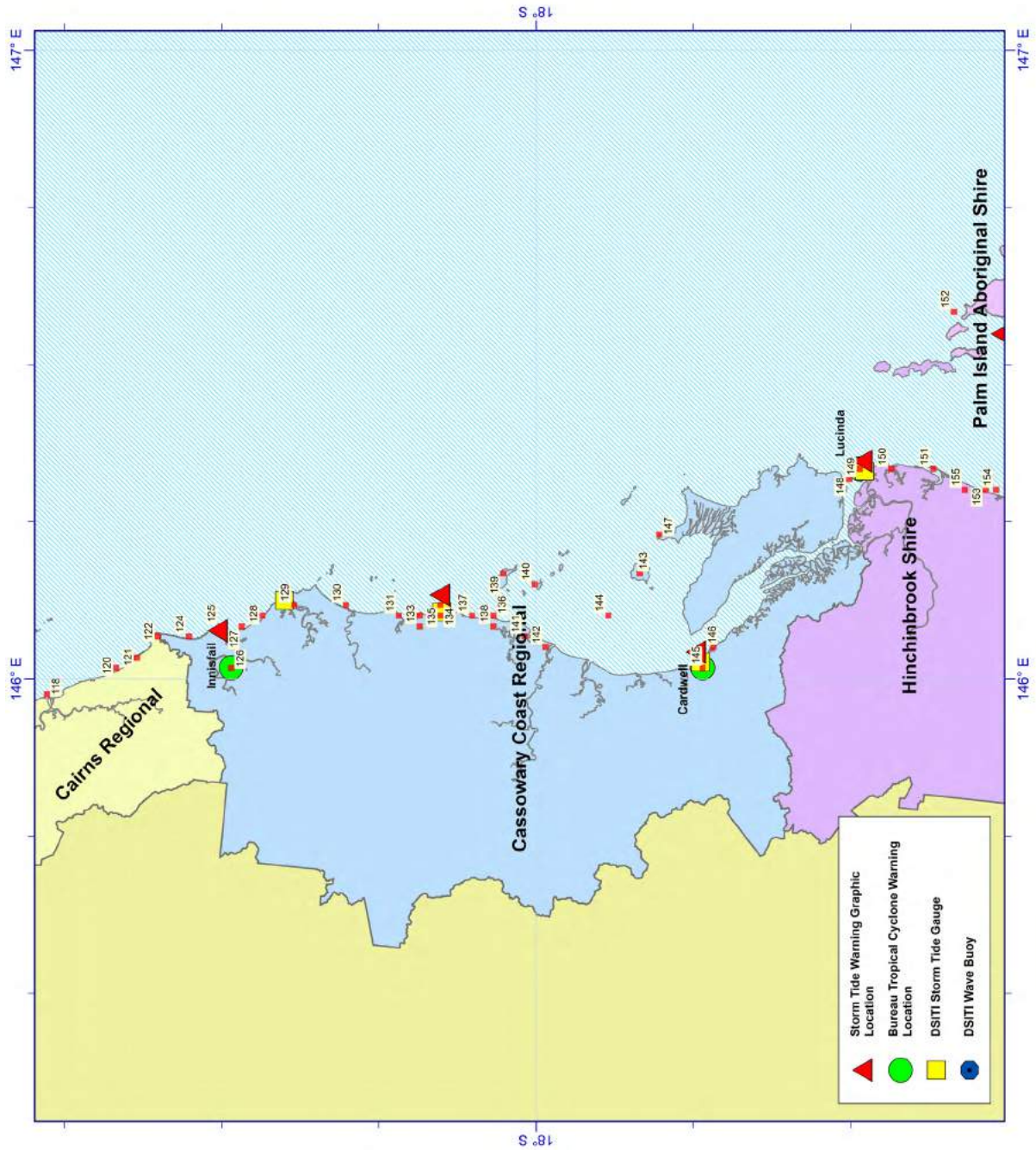
Map 3: Cairns Coastline cont.

Point Name	Lat.	Lon.	LGA	HAT (m) above AHD	Remarks	Date	Event	Reference Central Pressure (hPa)	Storm surge (m)	Storm Tide Level (m) AHD	Inundation Above HAT (m)
95 Oak Beach	-16.59987	145.52248	Douglas Shire	1.72							
96 Pretty Beach	-16.60973	145.52972	Douglas Shire	1.72							
97 Turtle Creek Beach	-16.62791	145.54889	Douglas Shire	1.69							
98 Wangetti	-16.65834	145.56695	Douglas Shire	1.69							
99 Ellis Beach	-16.72259	145.64335	Cairns Regional	1.64							
100 Palm Cove	-16.74433	145.67101	Cairns Regional	1.70	National Storm Tide Map						
101 Clifton Beach	-16.76041	145.67389	Cairns Regional	1.70	National Storm Tide Map						
102 Taylor Point	-16.77558	145.69475	Cairns Regional	1.78	National Storm Tide Map						
103 Kewarra Beach	-16.79086	145.68113	Cairns Regional	1.78	National Storm Tide Map						
104 Trinity Beach	-16.78519	145.70000	Cairns Regional	1.78	National Storm Tide Map						
105 Earl Hill	-16.79472	145.69998	Cairns Regional	1.78	National Storm Tide Map						
106 Half Moon Bay	-16.80223	145.71679	Cairns Regional	1.76	National Storm Tide Map						
107 Yorkeys Knob	-16.80277	145.72083	Cairns Regional	1.76	National Storm Tide Map						
108 Holloways Beach	-16.83626	145.73946	Cairns Regional	1.78	National Storm Tide Map						
109 Machans Beach	-16.85098	145.74999	Cairns Regional	1.81	National Storm Tide Map						

Map 3: Cairns Coastline cont.

Point Name	Lat.	Lon.	LGA	HAT (m) above AHD	Remarks	Date	Event	Reference Central Pressure (hPa)	Storm surge (m)	Storm Tide Level (m) AHD	Inundation Above HAT (m)
110 Barron Beach	-16.86694	145.76832	Cairns Regional	1.83	National Storm Tide Map						
111 Cairns	-16.92189	145.77585	Cairns Regional	1.85	National Storm Tide Map	3/02/2011	Yasi	988 929	1.15 1.09	2.5	0.7
112 Green Island	-16.75957	145.97491	Cairns Regional	1.67		1858				2	awash
113 Rolling Bay	-16.90743	145.80643	Cairns Regional	1.84							
114 Bessie Point (Gianguarra)	-16.90333	145.81223	Cairns Regional	1.84							
115 Second Beach (Lyons Point)	-16.88865	145.82723	Cairns Regional	1.84							
116 Koombal	-16.88174	145.83663	Cairns Regional	1.84							
117 Woolanmarroo	-17.21668	145.96668	Cairns Regional	1.63							
118 Russell Heads	-17.22736	145.97097	Cairns Regional	1.63							
119 Woolanmarroo South	-17.23336	145.96667	Cairns Regional	1.63							
120 Bramston Beach	-17.35236	146.02387	Cairns Regional	1.69							
121 Rocky Point	-17.36669	146.03332	Cairns Regional	1.73							
122 Cooper Point	-17.39999	146.06668	Cairns Regional	1.77							
123 Yarrabah	-16.90653	145.87167	Yarrabah Aboriginal Shire Council	1.86							

**Map 4: Cassowary Coastline**



Map 4: Cassowary Coastline cont.

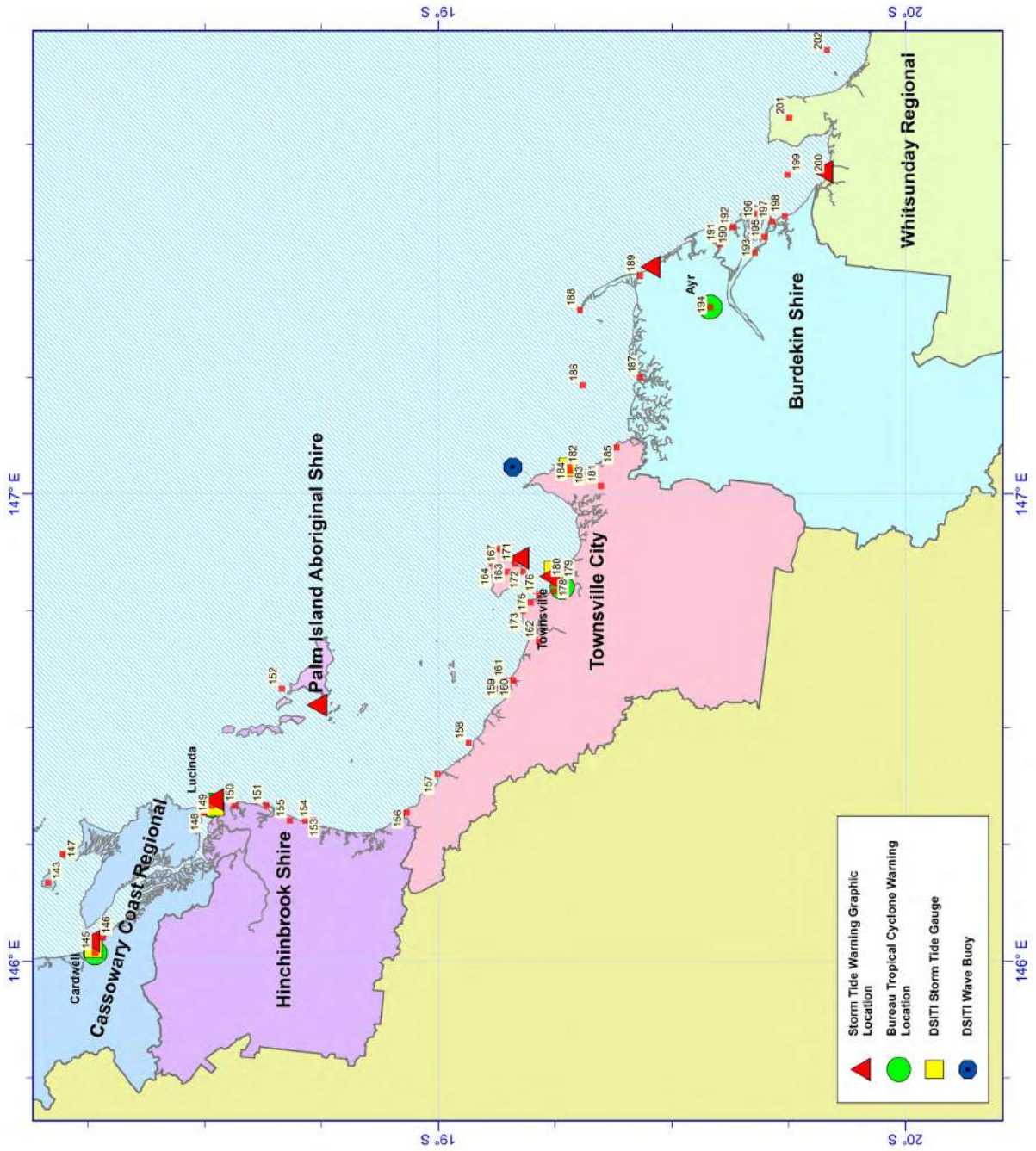
Point Name	Lat.	Lon.	LGA	HAT (m) above AHD	Remarks	Date	Event	Reference Central Pressure (hPa)	Storm surge (m)	Storm Tide Level (m) AHD	Inundation Above HAT (m)
124 Ella Bay	-17.45151	146.06751	Cassowary Coast Regional	1.82							
125 Flying Fish Point	-17.50500	146.07724	Cassowary Coast Regional	1.84							
126 Innisfail	-17.52383	146.03120	Cassowary Coast Regional	1.84		9/03/1918		928	2.3	3.9	2.3
127 Thompson Point	-17.53334	146.08333	Cassowary Coast Regional	1.84							
128 Etty Bay	-17.55930	146.09442	Cassowary Coast Regional	1.81							
129 Mourilyan Harbour	-17.61029	146.12197	Cassowary Coast Regional	1.76		20/03/2006 3/02/2011	Larry Yasi	929	1.3 1.32	1.6	
130 Cowley Beach	-17.69596	146.11222	Cassowary Coast Regional	1.79							
131 Kurrimine Beach	-17.77970	146.10390	Cassowary Coast Regional	1.85							
132 Garners Beach	-17.81401	146.10393	Cassowary Coast Regional	1.90							
133 Bingil Bay	-17.83320	146.10280	Cassowary Coast Regional	1.90							
134 Warragon Beach	-17.84931	146.10556	Cassowary Coast Regional	1.89							
135 Clump Point	-17.85001	146.11669	Cassowary Coast Regional	1.88		20/03/2006 3/02/2011	Larry Yasi	929	2.3 2.97	2.6 2.42	0.48
136 Mission Beach	-17.93912	146.09445	Cassowary Coast Regional	1.85							
137 Wongaling Beach	-17.90488	146.09751	Cassowary Coast Regional	1.87							
138 South Mission Beach	-17.94346	146.09277	Cassowary Coast Regional Council	1.85							

Map 4: Cassowary Coastline cont.

Point	Name	Lat.	Lon.	LGA	HAT (m) above AHD	Remarks	Date	Event	Reference Central Pressure (hPa)	Storm surge (m)	Storm Tide Level (m) AHD	Inundation Above HAT (m)
139	Dunk (Coonanglebah) Island	-17.94542	146.15776	Cassowary Coast Regional Council	1.80							
140	Richards (Bedarra) Island	-18.00427	146.14858	Cassowary Coast Regional Council	1.85							
141	Hull Heads	-17.99691	146.07032	Cassowary Coast Regional Council	1.83							
142	Tully Heads	-18.01915	146.05669	Cassowary Coast Regional Council	1.87							
143	Goold Island	-18.16554	146.17107	Cassowary Coast Regional Council	1.95							
144	Rockingham Bay	-18.14589	146.08110	Cassowary Coast Regional Council	2.92							
145	Cardwell	-18.26675	146.03337	Cassowary Coast Regional Council	2.22		20/03/2006	Larry	929	1.76	2.1	1.2
146	Oyster Point	-18.27746	146.04947	Cassowary Coast Regional Council	2.21							
147	Cape Richards (Hinčinbrook Island)	-18.19487	146.22945	Cassowary Coast Regional Council	1.93							



Map 5: Hinchinbrook, Townsville and Burdekin Coastlines





Map 5: Hinchinbrook, Townsville and Burdekin Coastlines cont.

Point Name	Lat.	Lon.	LGA	HAT (m) above AHD	Remarks	Date	Event	Reference Central Pressure (hPa)	Storm surge (m)	Storm Tide Level (m) AHD	Inundation Above HAT (m)
148 Dungeness	-18.52280	146.31777	Hinchinbrook Shire Council	2.13							
149 Lucinda	-18.53287	146.33482	Hinchinbrook Shire Council	2.13	National Storm Tide Map	24/12/1971 3/02/2011	Althea Yasi	952 929	0.9 >1.8	1.5	
150 Gentle Annie Creek	-18.56516	146.33441	Hinchinbrook Shire Council	2.13							
151 Taylors Beach	-18.63068	146.32585	Hinchinbrook Shire Council	2.16	National Storm Tide Map						
152 Palm Islands	-18.73512	146.57966	Palm Island Aboriginal Council	2.10	National Storm Tide Map	7/12/1964	Flora	996	0.6		
153 Forrest Beach	-18.71011	146.29973	Hinchinbrook Shire Council	2.20	National Storm Tide Map						
154 Cassidy Beach	-18.73001	146.29361	Hinchinbrook Shire Council	2.20							
155 Allingham	-18.70838	146.29532	Hinchinbrook Shire Council	2.16							
156 Crystal Creek	-18.92903	146.32152	Townsville City Council	2.23	National Storm Tide Map						
157 Balgal	-19.01696	146.41116	Townsville City Council	2.20	National Storm Tide Map						
158 Toomulla	-19.08059	146.47507	Townsville City Council	2.17	National Storm Tide Map						
159 Toolakea	-19.14446	146.57778	Townsville City Council	2.15	National Storm Tide Map	24/12/1971	Althea	952	3.6	3.3	1.1
160 Jalloonda	-19.15057	146.59890	Townsville City Council	2.12							
161 Saunders Beach	-19.15849	146.61029	Townsville City Council	2.12							
162 Mount Low	-19.20848	146.68301	Townsville City Council	2.16							

Map 5: Hinchinbrook, Townsville and Burdekin Coastlines cont.

Point Name	Lat.	Lon.	LGA	HAT (m) above AHD	Remarks	Date	Event	Reference Central Pressure (hPa)	Storm surge (m)	Storm Tide Level (m) AHD	Inundation Above HAT (m)
163 Magnetic Island	-19.13840	146.83451	Townsville City Council	2.14							
164 Horseshoe Bay	-19.11151	146.85252	Townsville City Council	2.14	National Storm Tide Map						
165 Radical Bay	-19.11121	146.87445	Townsville City Council	2.14	National Storm Tide Map						
166 Florence Bay	-19.12266	146.88083	Townsville City Council	2.14							
167 Arthur Bay	-19.13014	146.87834	Townsville City Council	2.14	National Storm Tide Map						
168 Arcadia (Alma Bay)	-19.15167	146.86145	Townsville City Council	2.14	National Storm Tide Map						
169 Alma Bay	-19.14881	146.87220	Townsville City Council	2.14	National Storm Tide Map						
170 Geoffrey Bay	-19.15475	146.86527	Townsville City Council	2.14							
171 Nelly Bay	-19.16501	146.85168	Townsville City Council	2.14	National Storm Tide Map						
172 Picnic Bay	-19.18182	146.84112	Townsville City Council	2.14	National Storm Tide Map						
173 Shelly Beach	-19.18125	146.75195	Townsville City Council	2.20	National Storm Tide Map						
174 Townsville	-19.26506	146.80110	Townsville City Council	2.25		24/12/1971 3/02/2011	Althea Yasil	952 929	2.9 2.36	2.6 2.62	0.4 0.37
175 Pallarenda	-19.19881	146.77391	Townsville City Council	2.22	National Storm Tide Map						
176 Rowes Bay	-19.21907	146.79030	Townsville City Council	2.22	National Storm Tide Map						
177 Belgian Gardens	-19.24544	146.79568	Townsville City Council	2.24							

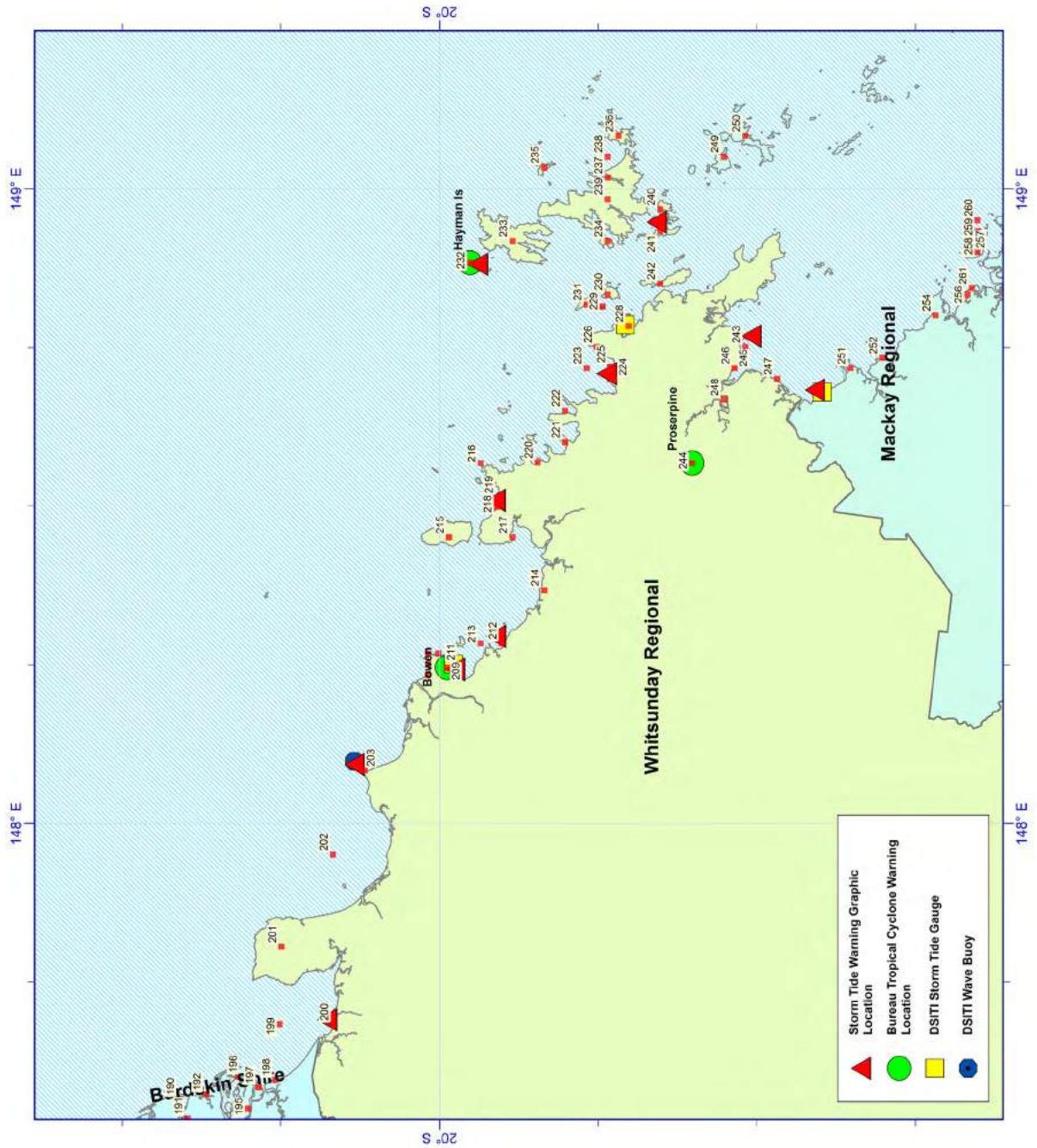
Map 5: Hinchinbrook, Townsville and Burdekin Coastlines cont.

Point Name	Lat.	Lon.	LGA	HAT (m) above AHD	Remarks	Date	Event	Reference Central Pressure (hPa)	Storm surge (m)	Storm Tide Level (m) AHD	Inundation Above HAT (m)
178 North Ward	-19.24779	146.80638	Townsville City Council	2.24	National Storm Tide Map						
179 Townsville City	-19.25766	146.81788	Townsville City Council	2.25							
180 Railway Estate	-19.27096	146.81665	Townsville City Council	2.24							
181 Cape Cleveland	-19.18203	147.01359	Townsville City Council	2.18							
182 Cape Ferguson	-19.27652	147.06112	Townsville City Council	2.15		03/02/2011	Yasi	929	2.01		
183 Ticklebelly Bay	-19.27639	147.05819	Townsville City Council	2.15							
184 Chunda Bay	-19.28043	147.05279	Townsville City Council	2.15							
185 Cunggulla	-19.39456	147.10896	Townsville City Council	2.15							
186 Bowling Green Bay	-19.36553	147.25332	Burdekin Shire Council	2.05							
187 Barratta Creek	-19.43431	147.24948	Burdekin Shire Council	2.13							
188 Cape Bowling Green	-19.30910	147.40393	Burdekin Shire Council	2.05							
189 Alva	-19.45556	147.48112	Burdekin Shire Council	1.98	National Storm Tide Map						
190 Phillips Camp	-19.59010	147.56620	Burdekin Shire Council	1.98							
191 Fieldings Landing	-19.60300	147.53450	Burdekin Shire Council	1.98							
192 Hell Hole	-19.63150	147.57260	Burdekin Shire Council	1.98							

Map 5: Hinchinbrook, Townsville and Burdekin Coastlines cont.

Point Name	Lat.	Lon.	LGA	HAT (m) above AHD	Remarks	Date	Event	Reference Central Pressure (hPa)	Storm surge (m)	Storm Tide Level (m) AHD	Inundation Above HAT (m)
193 Mays Landing	-19.67800	147.51810	Burdekin Shire Council	1.98							
194 Ayr	-19.57435	147.40666	Burdekin Shire Council	1.98	National Storm Tide Map						
195 Groper Creek	-19.69186	147.53000	Burdekin Shire Council	1.98							
196 Burdekin River	-19.65474	147.58785	Burdekin Shire Council	1.98	National Storm Tide Map						
197 Wunjunga	-19.73003	147.59236	Burdekin Shire Council	1.98	National Storm Tide Map						
198 Beachmount	-19.74244	147.59802	Burdekin Shire Council	1.98							
199 Upstart Bay	-19.75100	147.69091	Whitsunday Regional	1.97							

Map 6: Whitsunday Coastline





Map 6: Whitsunday Coastline cont.

Point Name	Lat.	Lon.	LGA	HAT (m) above AHD	Remarks	Date	Event	Reference Central Pressure (hPa)	Storm surge (m)	Storm Tide Level (m) AHD	Inundation Above HAT (m)
200 Molongle Creek	-19.83280	147.69943	Whitsunday Regional	2.01	National Storm Tide Map	4/04/1989	Aivu	935	3.2	3.7	1.7
201 Cape Upstart	-19.70630	147.75277	Whitsunday Regional	1.97	National Storm Tide Map						
202 Abbot Bay	-19.85070	147.96019	Whitsunday Regional	1.97							
203 Abbot Point	-19.88335	148.08331	Whitsunday Regional	1.97	National Storm Tide Map	28/02/1988	Charlie	972	0.4		
204 Queens Beach	-19.97745	148.23246	Whitsunday Regional	1.95	National Storm Tide Map						
205 Horseshoe Bay	-19.97903	148.26164	Whitsunday Regional	1.96							
206 Murray Bay	-19.98449	148.26501	Whitsunday Regional	1.96							
207 Rose Bay	-19.98987	148.26610	Whitsunday Regional	1.96							
208 Kings Beach	-20.00374	148.26525	Whitsunday Regional	1.96	National Storm Tide Map						
209 Bowen	-20.01053	148.24184	Whitsunday Regional	1.95	National Storm Tide Map	30/01/1884		hur	3.1		
210 Yumbabullo (Stone Island)	-20.03538	148.28515	Whitsunday Regional	1.96							
211 Port Denison	-20.03586	148.25196	Whitsunday Regional	1.96							
212 Brisk Bay	-20.09348	148.28555	Whitsunday Regional	1.96							
213 Heronvale	-20.10768	148.29402	Whitsunday Regional	1.96	National Storm Tide Map						
214 White Cliffs	-20.15815	148.36890	Whitsunday Regional	1.96	National Storm Tide Map						

Map 6: Whitsunday Coastline cont.

Point Name	Lat.	Lon.	LGA	HAT (m) above AHD	Remarks	Date	Event	Reference Central Pressure (hPa)	Storm surge (m)	Storm Tide Level (m) AHD	Inundation Above HAT (m)
215 Gloucester Island	-20.01410	148.45740	Whitsunday Regional	1.98							
216 George Point	-20.06678	148.56666	Whitsunday Regional	2.08							
217 Sinclair Bay	-20.11501	148.45276	Whitsunday Regional	1.98	National Storm Tide Map						
218 Dingo Beach	-20.08960	148.49880	Whitsunday Regional	2.01	National Storm Tide Map						
219 Nellie Bay	-20.09200	148.51440	Whitsunday Regional	2.03							
220 Earlando	-20.15480	148.56900	Whitsunday Regional	2.15							
221 Double Bay	-20.17472	148.61738	Whitsunday Regional	2.15							
222 Woodwork Bay	-20.19620	148.65428	Whitsunday Regional	2.19							
223 Pioneer Bay	-20.24564	148.71093	Whitsunday Regional	2.32	National Storm Tide Map						
224 Cannonvale	-20.28303	148.68832	Whitsunday Regional	2.30	National Storm Tide Map						
225 Airlie Beach	-20.26538	148.71862	Whitsunday Regional	2.30	National Storm Tide Map						
226 Funnel Bay	-20.25371	148.74725	Whitsunday Regional	2.36							
227 The Beak	-20.28338	148.80004	Whitsunday Regional	2.45							
228 Shute Harbour	-20.29916	148.78556	Whitsunday Regional	2.42		29/02/1988	Charlie	972	0.6		
229 Daydream Island	-20.25527	148.81392	Whitsunday Regional	2.40	National Storm Tide Map						

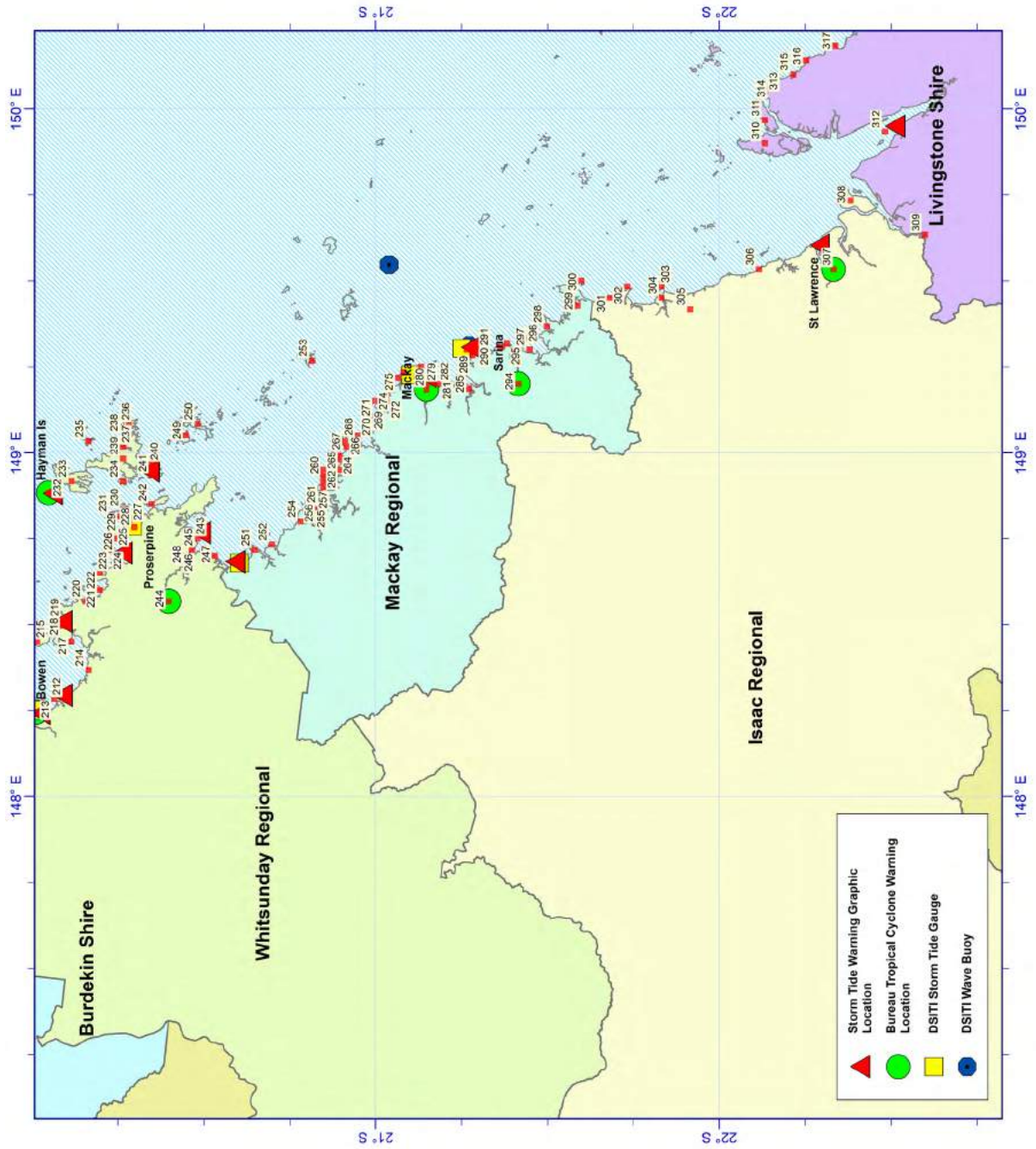
Map 6: Whitsunday Coastline cont.

Point Name	Lat.	Lon.	LGA	HAT (m) above AHD	Remarks	Date	Event	Reference Central Pressure (hPa)	Storm surge (m)	Storm Tide Level (m) AHD	Inundation Above HAT (m)
230 South Molle Island	-20.26922	148.83694	Whitsunday Regional	3.45	National Storm Tide Map						
231 North Molle Island	-20.22862	148.82111	Whitsunday Regional	2.37							
232 Hayman Is	-20.05096	148.88791	Whitsunday Regional	2.40	National Storm Tide Map						
233 Hook Island	-20.11671	148.92229	Whitsunday Regional	2.11	National Storm Tide Map						
234 Cid Island	-20.26365	148.91501	Whitsunday Regional	2.48							
235 Border Is.	-20.16305	149.03392	Whitsunday Regional	2.10							
236 Haslewood Island	-20.28137	149.08616	Whitsunday Regional	2.65							
237 Hill Inlet	-20.26002	149.02084	Whitsunday Regional	2.46							
238 Whitehaven Bay	-20.26730	149.05668	Whitsunday Regional	2.48							
239 Whitsunday Island	-20.25972	148.98055	Whitsunday Regional	2.60							
240 Hamilton Island	-20.35332	148.96197	Whitsunday Regional	2.80	National Storm Tide Map						
241 Dent Island	-20.35778	148.93251	Whitsunday Regional	2.67							
242 Long Island	-20.36496	148.85872	Whitsunday Regional	3.50							
243 Conway Beach	-20.47944	148.73984	Whitsunday Regional	3.49							
244 Proserpine	-20.40173	148.58091	Whitsunday Regional	3.34							

Map 6: Whitsunday Coastline cont.

Point Name	Lat.	Lon.	LGA	HAT (m) above AHD	Remarks	Date	Event	Reference Central Pressure (hPa)	Storm surge (m)	Storm Tide Level (m) AHD	Inundation Above HAT (m)
245 Wilson Beach	-20.47262	148.72385	Whitsunday Regional	3.33	National Storm Tide Map						
246 Deepwater Point	-20.46668	148.71666	Whitsunday Regional	3.33							
247 New Beach	-20.52558	148.70142	Whitsunday Regional	3.40							
248 Lethe Brook	-20.44844	148.66779	Whitsunday Regional	3.34							

Map 7: Mackay Coastline





Map 7: Mackay Coastline cont.

Point Name	Lat.	Lon.	LGA	HAT (m) above AHD	Remarks	Date	Event	Reference Central Pressure (hPa)	Storm surge (m)	Storm Tide Level (m) AHD	Inundation Above HAT (m)
249 Lindeman Is.	-20.44581	149.04246	Mackay Regional	2.62		15/02/1964	Gertie	983	0.6		
250 Shaw Island	-20.48668	149.07554	Mackay Regional	2.65							
251 Midge Point	-20.64919	148.72142	Mackay Regional	3.49	National Storm Tide Map						
252 Ten Mile Beach	-20.70011	148.73109	Mackay Regional	3.38							
253 Brampton Island	-20.80748	149.27258	Mackay Regional	3.17							
254 Mentmore Beach	-20.77294	148.79837	Mackay Regional	3.49							
255 Carpet Snake Point	-20.81672	148.83336	Mackay Regional	3.58							
256 St Helens Beach	-20.83508	148.84107	Mackay Regional	3.58	National Storm Tide Map						
257 Rabbit Island	-20.84194	148.90113	Mackay Regional	3.58							
258 Newry Island	-20.85308	148.92253	Mackay Regional	3.64							
259 Outer Newry Island	-20.84947	148.93327	Mackay Regional	3.64							
260 Newry Port	-20.85965	148.94000	Mackay Regional	3.64							
261 Wootooro	-20.83880	148.84350	Mackay Regional	3.58							
262 Seaforth	-20.90138	148.96750	Mackay Regional	3.51							
263 Halfway Bay	-20.90040	148.98010	Mackay Regional	3.53							

Map 7: Mackay Coastline cont.

Point Name	Lat.	Lon.	LGA	HAT (m) above AHD	Remarks	Date	Event	Reference Central Pressure (hPa)	Storm surge (m)	Storm Tide Level (m) AHD	Inundation Above HAT (m)
264 Haliday Bay	-20.89290	148.99140	Mackay Regional	3.51	National Storm Tide Map						
265 Ball Bay	-20.90228	149.01110	Mackay Regional	3.53							
266 Smalleys Bch	-20.91290	149.01415	Mackay Regional	3.51							
267 Cape Hillsborough	-20.90590	149.04920	Mackay Regional	3.51							
268 Sand Bay	-20.95020	149.05378	Mackay Regional	3.51							
269 Williamsons Beach	-20.98456	149.10137	Mackay Regional	3.52							
270 Neils Beach	-21.00057	149.11221	Mackay Regional	3.55							
271 Shoal Point	-21.00007	149.15005	Mackay Regional	3.55	National Storm Tide Map						
272 Bucasia	-21.03111	149.15998	Mackay Regional	3.56	National Storm Tide Map						
273 Eimeo (Dolphin Hds)	-21.03620	149.17639	Mackay Regional	3.56	National Storm Tide Map						
274 Blacks Beach	-21.05424	149.18664	Mackay Regional	3.58	National Storm Tide Map						
275 Slade Point	-21.06331	149.22506	Mackay Regional	3.61	National Storm Tide Map						
276 Lamberts Beach	-21.07433	149.22859	Mackay Regional	3.64	National Storm Tide Map						
277 Mackay Harbour	-21.13317	149.24970	Mackay Regional	3.64	National Storm Tide Map						
278 Harbour Beach	-21.11919	149.22323	Mackay Regional	3.64	National Storm Tide Map						

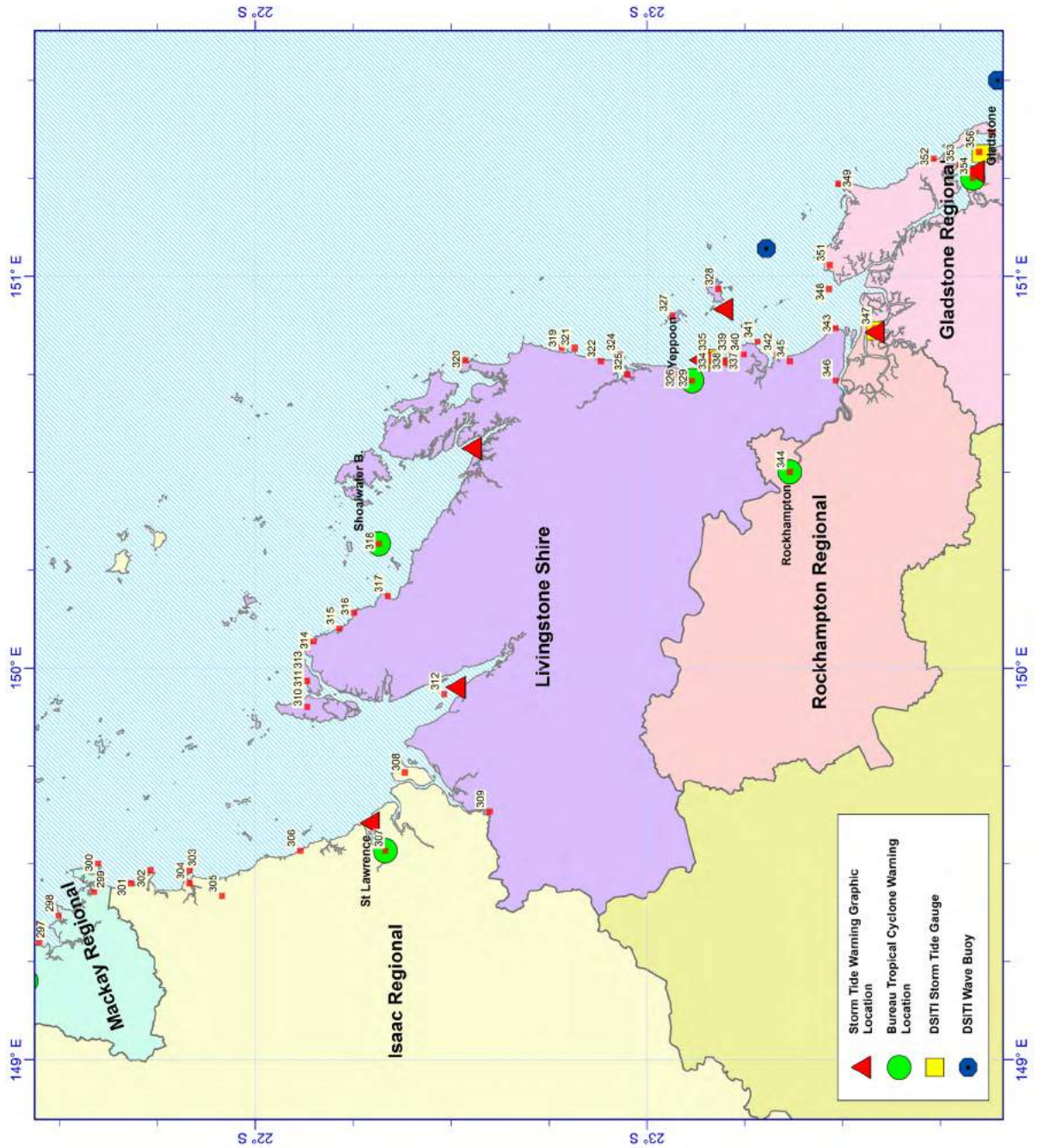
Map 7: Mackay Coastline cont.

Point	Name	Lat.	Lon.	LGA	HAT (m) above AHD	Remarks	Date	Event	Reference Central Pressure (hPa)	Storm surge (m)	Storm Tide Level (m) AHD	Inundation Above HAT (m)
279	Mackay Town Beach	-21.15532	149.20252	Mackay Regional	3.64	National Storm Tide Map						
280	Mackay	-21.14108	149.18588	Mackay Regional	3.64		21/01/1918		935	3.7	5.4	2
281	Far Beach	-21.18173	149.20108	Mackay Regional	3.70							
282	Bakers Creek	-21.21513	149.20108	Mackay Regional	3.75	National Storm Tide Map						
283	McEwens Beach	-21.25170	149.20531	Mackay Regional	3.77	National Storm Tide Map						
284	Sandringham Bay	-21.24991	149.22194	Mackay Regional	3.77							
285	Dunrock	-21.27170	149.18570	Mackay Regional	3.77							
286	Dudgeon Point	-21.25001	149.24999	Mackay Regional	3.77							
287	Louisa Creek	-21.26513	149.26778	Mackay Regional	3.78	National Storm Tide Map						
288	Hay Point	-21.27415	149.29393	Mackay Regional	3.80		19/01/1994	Rewa	970	0.5		
289	Half Tide	-21.29732	149.29197	Mackay Regional	3.78	National Storm Tide Map						
290	Victor Island	-21.32254	149.32266	Mackay Regional	3.84							
291	Salonika Beach	-21.32344	149.29414	Mackay Regional	3.84							
292	Grasfree Beach	-21.36376	149.30776	Mackay Regional	3.91	National Storm Tide Map						
293	Campwin Beach	-21.37499	149.31527	Mackay Regional	3.94	National Storm Tide Map						

Map 7: Mackay Coastline cont.

Point Name	Lat.	Lon.	LGA	HAT (m) above AHD	Remarks	Date	Event	Reference Central Pressure (hPa)	Storm surge (m)	Storm Tide Level (m) AHD	Inundation Above HAT (m)
294 Sarina	-21.41513	149.20108	Mackay Regional	3.93							
295 Sarina Beach	-21.38829	149.31361	Mackay Regional	3.94	National Storm Tide Map						
296 Freshwater Point	-21.43180	149.33525	Mackay Regional	3.98	National Storm Tide Map						
297 Armstrong Beach	-21.45121	149.29140	Mackay Regional	3.98	National Storm Tide Map						
298 Dawson Beach	-21.49948	149.37098	Mackay Regional	4.10							
299 C. Palmerston	-21.52953	149.48529	Mackay Regional	4.10							
300 Temple Island	-21.60121	149.49171	Mackay Regional	4.20							

Map 8: Isaac and Rockhampton Coastlines





Map 8: Isaac and Rockhampton Coastline cont.

Point Name	Lat.	Lon.	LGA	HAT (m) above AHD	Remarks	Date	Event	Reference Central Pressure (hPa)	Storm surge (m)	Storm Tide Level (m) AHD	Inundation Above HAT (m)
301 Green Hill	-21.68500	149.44945	Isaac Regional Council	4.32	National Storm Tide Map						
302 Notch Point	-21.73334	149.48334	Isaac Regional Council	4.42							
303 West Hill Is	-21.82879	149.48658	Isaac Regional Council	4.50							
304 West Hill Ck	-21.83173	149.45108	Isaac Regional Council	4.50							
305 Carmila	-21.91161	149.41035	Isaac Regional Council	4.57	National Storm Tide Map						
306 Clairview	-22.11751	149.53473	Isaac Regional Council	4.42	National Storm Tide Map						
307 St Lawrence	-22.34555	149.53532	Isaac Regional Council	5.08	National Storm Tide Map						
308 Rosewood Island	-22.38005	149.73001	Isaac Regional Council	5.10							
309 Styx	-22.59229	149.63524	Livingstone Shire	5.10							
310 Long Island	-22.12788	149.90533	Livingstone Shire	4.70							
311 Quail Island	-22.13600	149.97975	Livingstone Shire	4.70							
312 Herbert Creek	-22.48173	149.93439	Livingstone Shire	5.10							
313 Arthur Point	-22.12640	150.04391	Livingstone Shire	4.09							
314 Stanage Bay	-22.14945	150.06890	Livingstone Shire	4.09							
315 The Shacks (Hollins Ck)	-22.21512	150.10109	Livingstone Shire	4.10							

Map 8: Isaac and Rockhampton Coastline cont.

Point	Name	Lat.	Lon.	LGA	HAT (m) above AHD	Remarks	Date	Event	Reference Central Pressure (hPa)	Storm surge (m)	Storm Tide Level (m) AHD	Inundation Above HAT (m)
316	Yeniarindle Huts (Broome Head)	-22.25210	150.14220	Livingstone Shire	4.00							
317	Kreutzers Hut	-22.33770	150.18410	Livingstone Shire	4.05							
318	Shoalwater Bay	-22.34758	150.39364	Livingstone Shire	4.19							
319	Five Rocks Beach	-22.77880	150.80524	Livingstone Shire	2.78							
320	Cape Clinton	-22.53696	150.78890	Livingstone Shire	2.99							
321	Stockyard Point	-22.81897	150.81197	Livingstone Shire	2.78							
322	Nine Mile Beach	-22.88152	150.78581	Livingstone Shire	2.78							
323	Corio Bay	-22.93206	150.76830	Livingstone Shire	2.78							
324	Little Corio Bay	-22.93537	150.79664	Livingstone Shire	2.78							
325	Sandy Point	-22.95011	150.76667	Livingstone Shire	2.78		19/01/1976	David	961	1.2	2.7	
326	Farnborough	-23.06821	150.76821	Livingstone Shire	2.78	National Storm Tide Map						
327	North Keppel Island	-23.07292	150.89804	Livingstone Shire	2.64							
328	Great Keppel Island	-23.17614	150.96058	Livingstone Shire	2.64							
329	Yeppoon	-23.12886	150.74448	Livingstone Shire	2.78	National Storm Tide Map						
330	Cooee Bay	-23.14093	150.76053	Livingstone Shire	2.78	National Storm Tide Map						

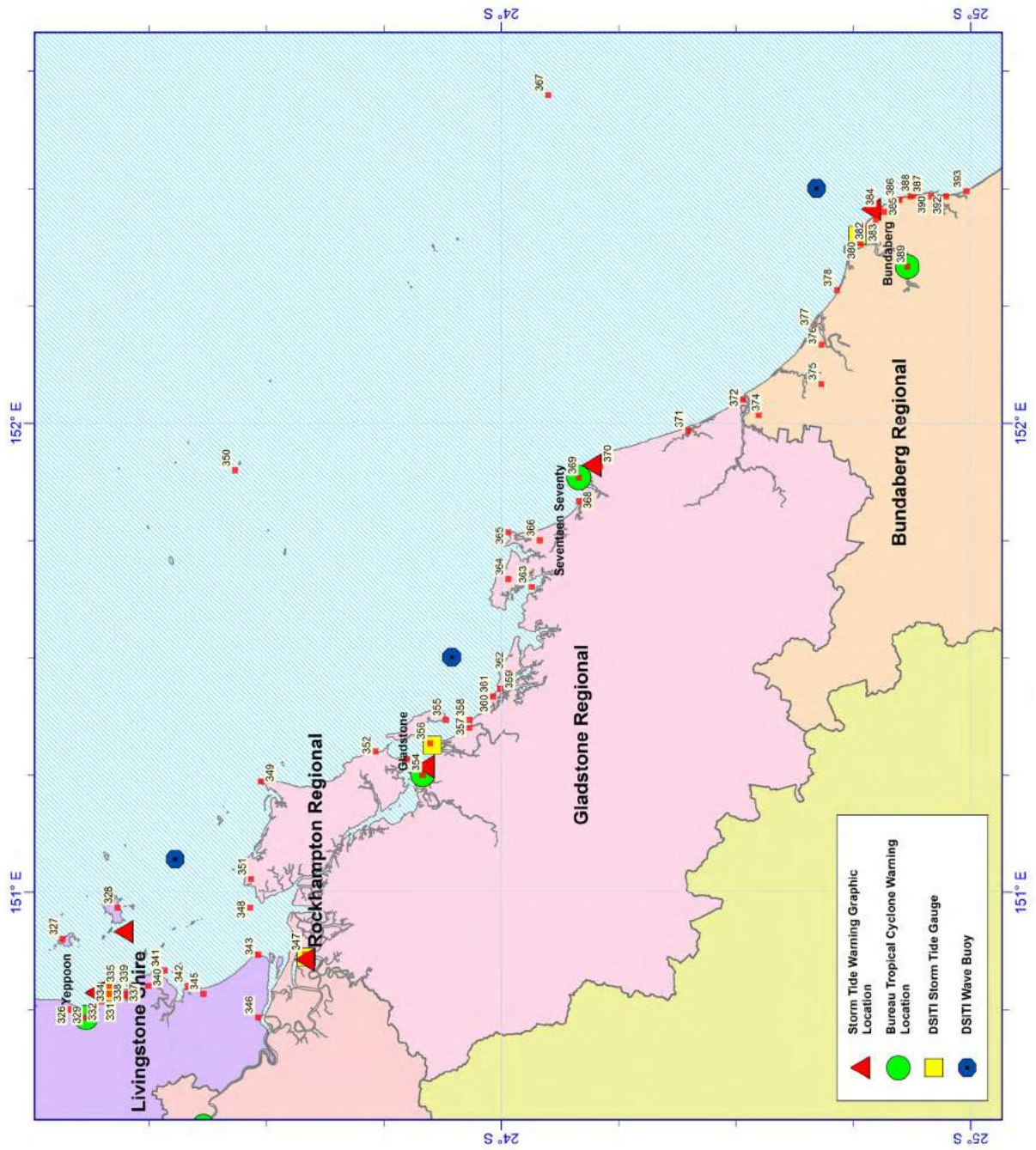
Map 8: Isaac and Rockhampton Coastline cont.

Point Name	Lat.	Lon.	LGA	HAT (m) above AHD	Remarks	Date	Event	Reference Central Pressure (hPa)	Storm surge (m)	Storm Tide Level (m) AHD	Inundation Above HAT (m)
331 Wreck Point	-23.14390	150.76391	Livingstone Shire	2.78							
332 Lammermoor Beach	-23.14956	150.76498	Livingstone Shire	2.78							
333 Statue Bay	-23.16586	150.78114	Livingstone Shire	2.78							
334 Rosslyn Bay	-23.16170	150.78751	Livingstone Shire	2.78	National Storm Tide Map	19/01/1976	David	961	1.2	2.7	
335 Kemp Beach	-23.17093	150.79136	Livingstone Shire	2.78							
336 Mulambin	-23.19707	150.79248	Livingstone Shire	2.79	National Storm Tide Map						
337 North Causeway Lake	-23.19775	150.78344	Livingstone Shire	2.79	National Storm Tide Map						
338 South. Causeway Lake	-23.20050	150.78050	Livingstone Shire	2.79	National Storm Tide Map						
339 Kinka Beach	-23.21617	150.79309	Livingstone Shire	2.80	National Storm Tide Map						
340 Emu Park	-23.25925	150.82389	Livingstone Shire	2.78	National Storm Tide Map						
341 Zilizie Point	-23.27977	150.82475	Livingstone Shire	2.79	National Storm Tide Map						
342 Keppel Sands	-23.32971	150.79333	Livingstone Shire	2.80	National Storm Tide Map						
343 Cattle Point	-23.47728	150.87140	Livingstone Shire	2.81							
344 Rockhampton	-23.37809	150.51375	Rockhampton Regional Council	3.90							
345 Joskeleigh	-23.36724	150.77603	Livingstone Shire	2.80							

Map 8: Isaac and Rockhampton Coastline cont.

Point	Name	Lat.	Lon.	LGA	HAT (m) above AHD	Remarks	Date	Event	Reference Central Pressure (hPa)	Storm surge (m)	Storm Tide Level (m) AHD	Inundation Above HAT (m)
346	Thompson Point	-23.48339	150.73334	Livingstone Shire	3-24							
347	Port Alma	-23.58313	150.86083	Rockhampton Regional Council	3-13		2/04/1972	Emily	985	0.6	1.4	

Map 9: Gladstone Coastline





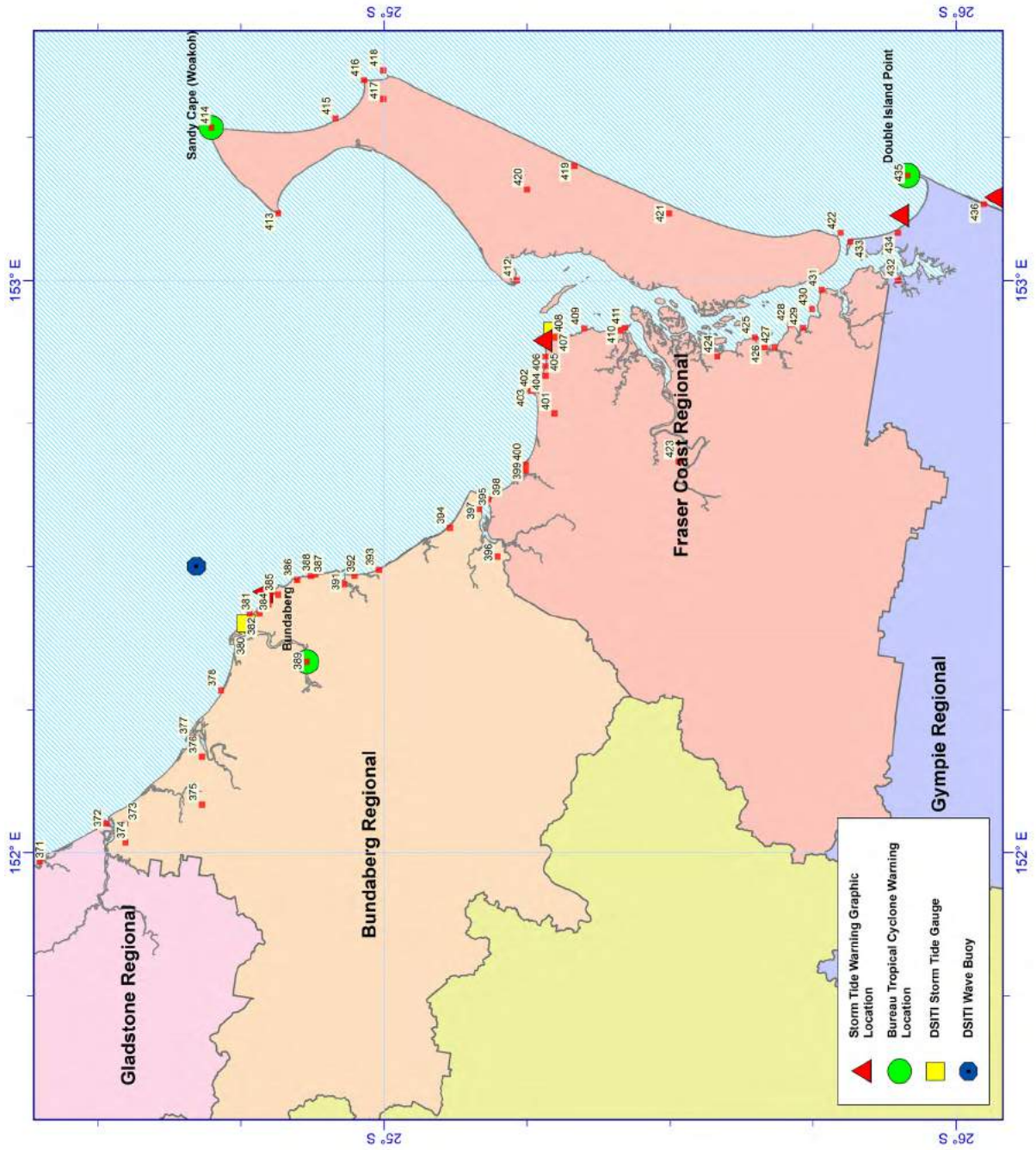
Map 9: Gladstone Coastline cont.

Point	Name	Lat.	Lon.	LGA	HAT (m) above AHD	Remarks	Date	Event	Reference Central Pressure (hPa)	Storm surge (m)	Storm Tide Level (m) AHD	Inundation Above HAT (m)
348	Beachton	-23.48907	150.97897	Gladstone Regional Council	2.74							
349	C Capricorn	-23.48152	151.23164	Gladstone Regional Council	2.29							
350	Heron Island	-23.44285	151.91532	Gladstone Regional Council	1.86		2/04/1972	Emily	985	1.2		
351	Spadeley (Curtis Island)	-23.46690	151.02910	Gladstone Regional Council	2.69							
352	Southend (Curtis Island)	-23.75668	151.31059	Gladstone Regional Council	2.25							
353	Quoin Island	-23.80586	151.28648	Gladstone Regional Council	2.50							
354	Gladstone	-23.84279	151.25561	Gladstone Regional Council	2.56	National Storm Tide Map	2/03/1949		988	>1.2	2.2	0.2
355	Gatcombe Hd Facing Is	-23.88080	151.37423	Gladstone Regional Council	2.21							
356	South Trees Point	-23.85006	151.31670	Gladstone Regional Council	2.40	National Storm Tide Map						
357	Boyne Island	-23.94770	151.35503	Gladstone Regional Council	2.29	National Storm Tide Map						
358	Tannum Sands	-23.94749	151.36752	Gladstone Regional Council	2.29	National Storm Tide Map	2/04/1972	Emily	985	0.9		
359	Colosseum Inlet	-24.02003	151.43846	Gladstone Regional Council	2.24							
360	Wild Cattle Island	-23.98430	151.41206	Gladstone Regional Council	2.24							
361	Bangalee	-24.00529	151.43194	Gladstone Regional Council	2.24							
362	Hummock Hill	-24.01113	151.47505	Gladstone Regional Council	2.20							

Map 9: Gladstone Coastline cont.

Point	Name	Lat.	Lon.	LGA	HAT (m) above AHD	Remarks	Date	Event	Reference Central Pressure (hPa)	Storm surge (m)	Storm Tide Level (m) AHD	Inundation Above HAT (m)
363	Turkey Beach	-24.08253	151.65146	Gladstone Regional Council	2.09	*Access road could be cut by floods						
364	Rodds Peninsula	-24.01630	151.67804	Gladstone Regional Council	2.09							
365	Bustard Hd	-24.01671	151.76666	Gladstone Regional Council	1.90		2/04/1972	Emily	985	1.8		
366	Middle Island	-24.09001	151.74982	Gladstone Regional Council	1.90							
367	Lady Elliot Island	-24.11299	152.71418	Gladstone Regional Council	1.55		29/01/1967	Dinah	945			awash
368	Eurimbula Beach	-24.16819	151.83438	Gladstone Regional Council	1.97							
369	Seventeen Seventy	-24.16335	151.88528	Gladstone Regional Council	1.97							
370	Agnes Water	-24.21260	151.90331	Gladstone Regional Council	1.97		2/04/1972	Emily	985	1.5		
371	Deepwater Creek	-24.39842	151.98436	Gladstone Regional Council	0.95							
372	Baffle Creek	-24.52094	152.05472	Gladstone Regional Council	1.55							

Map 10: Bundaberg and Fraser Coast Coastlines



Map 10: Bundaberg and Fraser Coast Coastlines cont.

Point Name	Lat.	Lon.	LGA	HAT (m) above AHD	Remarks	Date	Event	Reference Central Pressure (hPa)	Storm surge (m)	Storm Tide Level (m) AHD	Inundation Above HAT (m)
373 Boaga	-24.54842	152.05106	Bundaberg Regional Council	1.55							
374 Winfield	-24.55881	152.00421	Bundaberg Regional Council	1.51							
375 Littabella	-24.68471	152.07783	Bundaberg Regional Council	1.88							
376 Miara	-24.68751	152.16975	Bundaberg Regional Council	2.04							
377 Kolan River	-24.66512	152.20105	Bundaberg Regional Council	2.06							
378 Moore Park	-24.71741	152.27814	Bundaberg Regional Council	1.98	National Storm Tide Map						
379 Skyringville	-24.74841	152.36775	Bundaberg Regional Council	1.98							
380 Fairymead Creek	-24.76937	152.36524	Bundaberg Regional Council	1.98	National Storm Tide Map						
381 Burnett Heads	-24.75926	152.40615	Bundaberg Regional Council	1.98	National Storm Tide Map	16/03/1992	Fran	980	1	2.1	0.2
382 The Oaks	-24.77127	152.41876	Bundaberg Regional Council	1.88							
383 Mon Repos	-24.78895	152.44166	Bundaberg Regional Council	1.90	National Storm Tide Map						
384 Neilson Park	-24.80749	152.45668	Bundaberg Regional Council	1.98							
385 Bargara	-24.82058	152.46254	Bundaberg Regional Council	1.98	National Storm Tide Map						
386 Rifle Range Creek	-24.84760	152.47740	Bundaberg Regional Council	2.01							
387 Innes Park	-24.86617	152.48050	Bundaberg Regional Council	2.06	National Storm Tide Map						

Map 10: Bundaberg and Fraser Coast Coastlines cont.

Point	Name	Lat.	Lon.	LGA	HAT (m) above AHD	Remarks	Date	Event	Reference Central Pressure (hPa)	Storm surge (m)	Storm Tide Level (m) AHD	Inundation Above HAT (m)
388	Barolin	-24.88335	152.48337	Bundaberg Regional Council	2.06							
389	Bundaberg	-24.86616	152.34949	Bundaberg Regional Council	2.25		2/04/1972	Emily	985	0.9	1.5	
390	Elliott Hds	-24.91200	152.49029	Bundaberg Regional Council	2.06	National Storm Tide Map						
391	Riverview	-24.93060	152.46960	Bundaberg Regional Council	2.06							
392	Coonarr	-24.95863	152.48495	Bundaberg Regional Council	2.06	National Storm Tide Map						
393	Palm Beach	-24.99140	152.49530	Bundaberg Regional Council	2.08							
394	Woodgate	-25.10271	152.56059	Bundaberg Regional Council	2.13	National Storm Tide Map						
395	Walkers Point	-25.17007	152.59141	Bundaberg Regional Council	2.08							
396	Buxton	-25.19790	152.53825	Bundaberg Regional Council	2.06	National Storm Tide Map						
397	Burrum River	-25.17571	152.62310	Fraser Coast Regional Council	2.16							
398	Burrum Heads	-25.18421	152.61391	Fraser Coast Regional Council	2.16	National Storm Tide Map						
399	Toogoom	-25.24593	152.67108	Fraser Coast Regional Council	2.20	National Storm Tide Map						
400	Toogoom East	-25.25902	152.69590	Fraser Coast Regional Council	2.20							
401	Dundowran	-25.28947	152.76814	Fraser Coast Regional Council	2.22	National Storm Tide Map						
402	Point Vernon West	-25.25700	152.80800	Fraser Coast Regional Council	2.22							

Map 10: Bundaberg and Fraser Coast Coastlines cont.

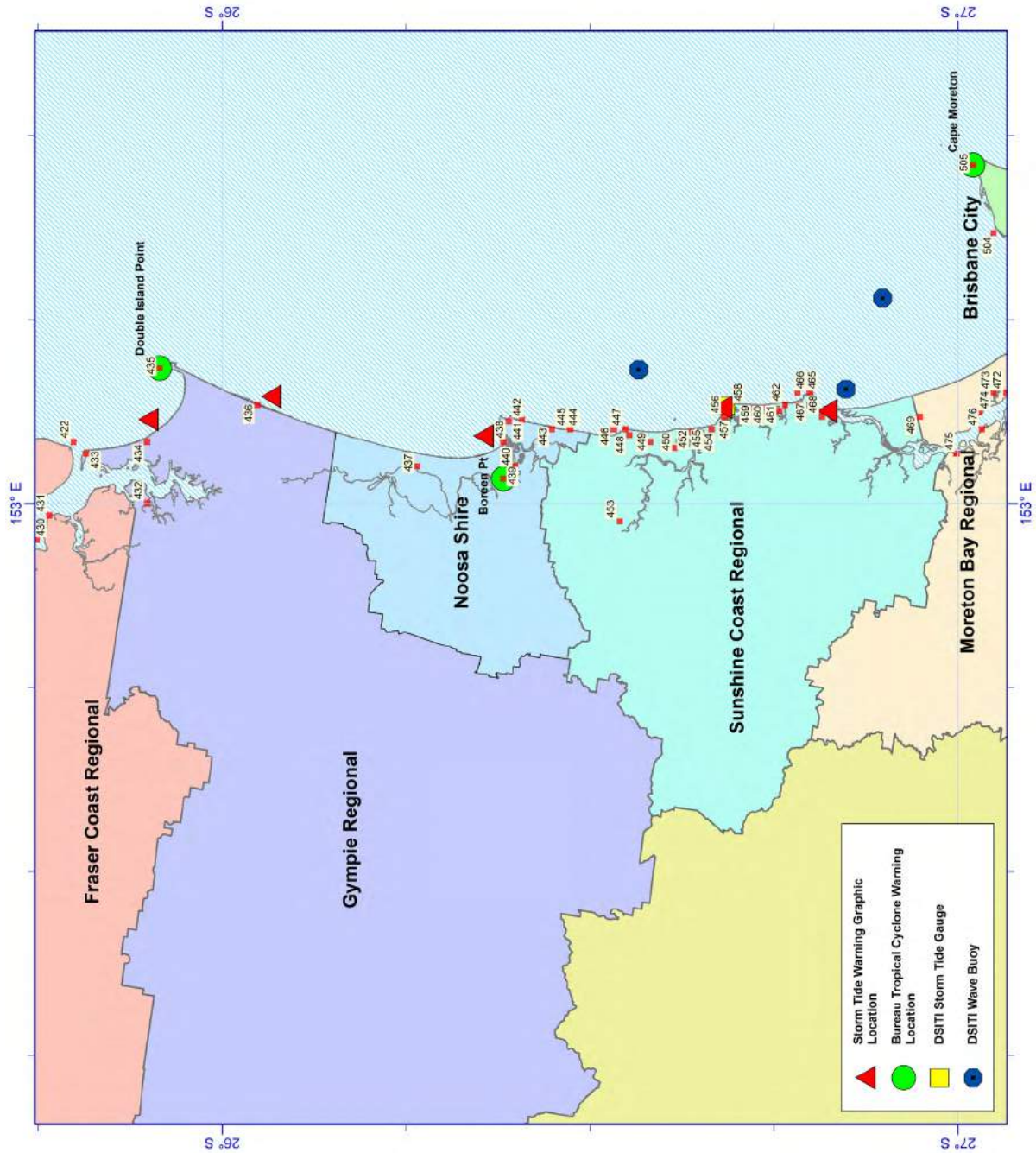
Point Name	Lat.	Lon.	LGA	HAT (m) above AHD	Remarks	Date	Event	Reference Central Pressure (hPa)	Storm surge (m)	Storm Tide Level (m) AHD	Inundation Above HAT (m)
403 Point Vernon	-25.25007	152.81671	Fraser Coast Regional Council	2.22	National Storm Tide Map						
404 Ptalba	-25.28058	152.83867	Fraser Coast Regional Council	2.23	National Storm Tide Map						
405 Scarness	-25.28445	152.85761	Fraser Coast Regional Council	2.23	National Storm Tide Map						
406 Torquay	-25.28430	152.87140	Fraser Coast Regional Council	2.24	National Storm Tide Map						
407 Urangan	-25.28155	152.90087	Fraser Coast Regional Council	2.24	National Storm Tide Map	16/03/1992	Fran	980	0.7	2.2	
408 Urangan Harbour	-25.29584	152.91059	Fraser Coast Regional Council	2.24	National Storm Tide Map						
409 Mangrove Point	-25.36471	152.91752	Fraser Coast Regional Council	2.32							
410 River Heads	-25.41333	152.91362	Fraser Coast Regional Council	2.43	National Storm Tide Map						
411 Bingham	-25.42921	152.92230	Fraser Coast Regional Council	2.43							
412 Mooran	-25.23171	153.00105	Fraser Coast Regional Council	2.17							
413 Rooney Point	-24.81676	153.11665	Fraser Coast Regional Council	1.84							
414 Sandy Cape (Woakoh)	-24.70015	153.26334	Fraser Coast Regional Council	1.34							
415 Orchid Beach	-24.91512	153.28133	Fraser Coast Regional Council	3.36							
416 Waddy Point (Minker)	-24.96511	153.35104	Fraser Coast Regional Council	1.36							
417 Wathumba	-24.98336	153.23032	Fraser Coast Regional Council	2.02							



Map 10: Bundaberg and Fraser Coast Coastlines cont.

Point Name	Lat.	Lon.	LGA	HAT (m) above AHD	Remarks	Date	Event	Reference Central Pressure (hPa)	Storm surge (m)	Storm Tide Level (m) AHD	Inundation Above HAT (m)
418 Indian Head	-25.00607	153.35946	Fraser Coast Regional Council	1.36							
419 Happy Valley	-25.33751	153.20055	Fraser Coast Regional Council	1.31							
420 Fraser Island	-25.24863	153.16503	Fraser Coast Regional Council	1.31		11/02/1972	Daisy	959	3		
421 Eurong	-25.51139	153.12611	Fraser Coast Regional Council	1.29							
422 Hook Point	-25.79156	153.07668	Fraser Coast Regional Council	1.25							
423 Maryborough	-25.53740	152.70206	Fraser Coast Regional Council	2.70							
424 Maaroom	-25.60983	152.87276	Fraser Coast Regional Council	2.00							
425 Boonooroo	-25.66841	152.90195	Fraser Coast Regional Council	1.70							
426 Little Tuan Creek	-25.67333	152.87834	Fraser Coast Regional Council	1.64							
427 Big Tuan Creek	-25.68452	152.87910	Fraser Coast Regional Council	1.62							
428 Poona	-25.71038	152.92217	Fraser Coast Regional Council	1.50							
429 Tawan	-25.74452	152.93217	Fraser Coast Regional Council	1.50							
430 Tinnanbar	-25.75863	152.95781	Fraser Coast Regional Council	1.40							
431 Cowra Point	-25.76780	152.97504	Fraser Coast Regional Council	1.40							

Map 11: Gympie and Sunshine Coast Coastlines



Map 11: Gympie and Sunshine Coast Coastlines cont.

Point	Name	Lat.	Lon.	LGA	HAT (m) above AHD	Remarks	Date	Event	Reference Central Pressure (hPa)	Storm surge (m)	Storm Tide Level (m) AHD	Inundation Above HAT (m)
432	Tin Can Bay	-25.91641	153.00366	Gympie Regional Council	1.58	National Storm Tide Map						
433	Inskip Point	-25.81116	153.07278	Gympie Regional Council	1.25							
434	Rainbow Beach	-25.90749	153.08890	Gympie Regional Council	1.24	National Storm Tide Map						
435	Double Island Point	-25.93014	153.18587	Gympie Regional Council	1.16							
436	Cooloola Beach	-26.04842	153.13633	Gympie Regional Council	1.22							
437	Teewah	-26.27805	153.06419	Noosa Shire	1.17							
438	Noosa River	-26.38171	153.08435	Noosa Shire	0.86							
439	Boreen Point	-26.28510	152.99831	Noosa Shire	0.43		17/03/1993	Roger	985	0.5		
440	Tewantin	-26.39171	153.03862	Noosa Shire	0.55							
441	Noosaville	-26.39806	153.06168	Noosa Shire	0.70	National Storm Tide Map	17/03/1993	Roger	985	0.6	0.9	
442	Noosa Heads	-26.38703	153.09134	Noosa Shire	1.16		24/01/1974	Wanda	995	0.6		
443	Sunshine Beach	-26.40674	153.11301	Noosa Shire	1.16							
444	Marcus Beach	-26.44702	153.10384	Noosa Shire	1.16							
445	Peregian Beach	-26.48007	153.09854	Noosa Shire	1.16							
446	Coolum Beach	-26.53009	153.09301	Sunshine Coast Regional Council	1.17	National Storm Tide Map						

Map 11: Gympie and Sunshine Coast Coastlines cont.

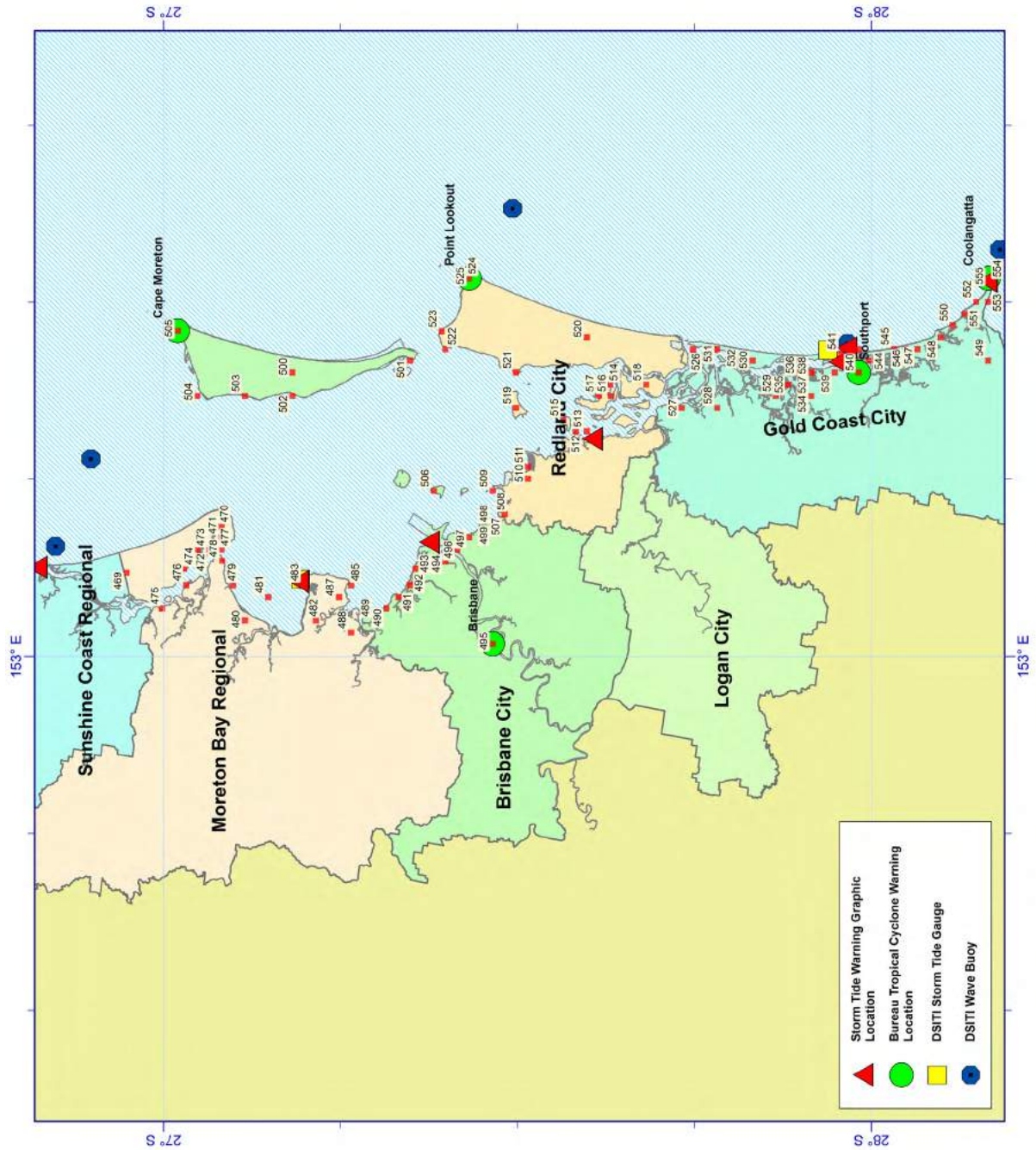
Point Name	Lat.	Lon.	LGA	HAT (m) above AHD	Remarks	Date	Event	Reference Central Pressure (hPa)	Storm surge (m)	Storm Tide Level (m) AHD	Inundation Above HAT (m)
447 Point Arkwright	-26.54661	153.10286	Sunshine Coast Regional Council	1.17							
448 Yaroomba	-26.54978	153.10164	Sunshine Coast Regional Council	1.17	National Storm Tide Map						
449 Marcoola	-26.58342	153.09557	Sunshine Coast Regional Council	1.17	National Storm Tide Map						
450 Pacific Paradise	-26.61587	153.08090	Sunshine Coast Regional Council	0.90	National Storm Tide Map						
51 Mudjimba	-26.61501	153.10194	Sunshine Coast Regional Council	1.17	National Storm Tide Map						
452 Twin Waters	-26.62974	153.08562	Sunshine Coast Regional Council	1.18	National Storm Tide Map						
453 Ninderry	-26.54775	152.96812	Sunshine Coast Regional Council	1.08	National Storm Tide Map						
454 Cotton Tree (Maroochy River)	-26.65285	153.10049	Sunshine Coast Regional Council	1.18	National Storm Tide Map						
455 Maroochydore	-26.65536	153.09331	Sunshine Coast Regional Council	0.95	National Storm Tide Map						
456 Alexandra Head	-26.67407	153.11369	Sunshine Coast Regional Council	1.18	National Storm Tide Map						
457 Mooloolaba	-26.68119	153.12174	Sunshine Coast Regional Council	1.18	National Storm Tide Map						
458 Buddina	-26.70470	153.12996	Sunshine Coast Regional Council	1.18							
459 Warana	-26.72858	153.12888	Sunshine Coast Regional Council	1.17							
460 Bokarina	-26.73613	153.12964	Sunshine Coast Regional Council	1.13							
461 Wurtulla	-26.76001	153.12451	Sunshine Coast Regional Council	1.10							

Map 11: Gympie and Sunshine Coast Coastlines cont.

Point	Name	Lat.	Lon.	LGA	HAT (m) above AHD	Remarks	Date	Event	Reference Central Pressure (hPa)	Storm surge (m)	Storm Tide Level (m) AHD	Inundation Above HAT (m)
462	Currimundi	-26.76511	153.13435	Sunshine Coast Regional Council	1.10	National Storm Tide Map						
463	Dicky Beach	-26.78286	153.13940	Sunshine Coast Regional Council	1.08	National Storm Tide Map						
464	Moffat Beach	-26.78900	153.14249	Sunshine Coast Regional Council	1.08							
465	Shelly Beach	-26.79759	153.14885	Sunshine Coast Regional Council	1.06							
466	Kings Beach	-26.80425	153.14161	Sunshine Coast Regional Council	1.06	National Storm Tide Map						
467	Caloundra	-26.80477	153.13388	Sunshine Coast Regional Council	1.06							
468	Golden Beach	-26.82120	153.12164	Sunshine Coast Regional Council	0.96	National Storm Tide Map						



Map 12: Moreton Bay, Brisbane, Redlands and Gold Coast Coastlines





Map 12: Moreton Bay, Brisbane, Redlands and Gold Coast Coastlines cont.

Point Name	Lat.	Lon.	LGA	HAT (m) above AHD	Remarks	Date	Event	Reference Central Pressure (hPa)	Storm surge (m)	Storm Tide Level (m) AHD	Inundation Above HAT (m)
469 Bribie Island	-26.95066	153.12437	Moreton Bay Regional Council	1.15		11/02/1972	Daisy	959	0.8		
470 Woorim	-27.06777	153.20345	Moreton Bay Regional Council	1.23	National Storm Tide Map						
471 Bongaree	-27.08153	153.15846	Moreton Bay Regional Council	1.25	National Storm Tide Map						
472 Bellara	-27.06623	153.14940	Moreton Bay Regional Council	1.26	National Storm Tide Map						
473 Banksia Beach	-27.04460	153.13722	Moreton Bay Regional Council	1.29	National Storm Tide Map						
474 Old Bribie	-27.02930	153.12370	Moreton Bay Regional Council	1.34							
475 Donnybrook	-27.00480	153.06998	Moreton Bay Regional Council	1.23	National Storm Tide Map						
476 Toorbul	-27.03640	153.10029	Moreton Bay Regional Council	1.35	National Storm Tide Map						
477 Toorbul Point	-27.07557	153.14419	Moreton Bay Regional Council	1.25	National Storm Tide Map						
478 Pebble Beach	-27.08270	153.13500	Moreton Bay Regional Council	1.25							
479 Godwin Beach	-27.08732	153.11026	Moreton Bay Regional Council	1.28	National Storm Tide Map						
480 Beachmere	-27.12945	153.05397	Moreton Bay Regional Council	1.30	National Storm Tide Map						
481 Deception Bay	-27.14924	153.09223	Moreton Bay Regional Council	1.30	National Storm Tide Map						
482 Rothwell	-27.21481	153.04686	Moreton Bay Regional Council	1.36							
483 Scarborough	-27.19425	153.10694	Moreton Bay Regional Council	1.26							

Map 12: Moreton Bay, Brisbane, Redlands and Gold Coast Coastlines cont.

Point Name	Lat.	Lon.	LGA	HAT (m) above AHD	Remarks	Date	Event	Reference Central Pressure (hPa)	Storm surge (m)	Storm Tide Level (m) AHD	Inundation Above HAT (m)
484 Redcliffe	-27.22780	153.11501	Moreton Bay Regional Council	1.45							
485 Woody Point	-27.26304	153.10391	Moreton Bay Regional Council	1.36							
486 Margate	-27.24507	153.10690	Moreton Bay Regional Council	1.33							
487 Clontarf	-27.25323	153.08198	Moreton Bay Regional Council	1.36							
488 Dohle's Rocks	-27.27838	153.03921	Moreton Bay Regional Council	1.43	National Storm Tide Map						
489 Brighton	-27.30478	153.06272	Brisbane City Council	1.39							
490 Sandgate	-27.31796	153.06770	Brisbane City Council	1.37							
491 Shorncliffe	-27.32460	153.08242	Brisbane City Council	1.37							
492 Nudgee Beach	-27.34417	153.10279	Brisbane City Council	1.37							
493 Cribb Island	-27.35636	153.12425	Brisbane City Council	1.37							
494 Myrtle town	-27.39840	153.13437	Brisbane City Council	1.60							
495 Brisbane	-27.46783	153.02811	Brisbane City Council	1.49		1/02/1934			1.2		
496 Lytton	-27.42234	153.14798	Brisbane City Council	1.60							
497 Wynnum	-27.44377	153.17371	Brisbane City Council	1.55							
498 Manly	-27.45427	153.18588	Brisbane City Council	1.52							

Map 12: Moreton Bay, Brisbane, Redlands and Gold Coast Coastlines cont.

Point Name	Lat.	Lon.	LGA	HAT (m) above AHD	Remarks	Date	Event	Reference Central Pressure (hPa)	Storm surge (m)	Storm Tide Level (m) AHD	Inundation Above HAT (m)
499 Lota	-27.46738	153.19231	Brisbane City Council	1.52							
500 Moreton Island (Gnoorgambin)	-27.16855	153.40101	Brisbane City Council	1.36		29/01/1967	Dinah	945	0.5		
501 Koorringal	-27.34997	153.42056	Brisbane City Council	1.22							
502 Tangalooma (Turebin)	-27.17776	153.37488	Brisbane City Council	1.36							
503 Cowan Cowan	-27.12585	153.36615	Brisbane City Council	1.36							
504 Bullwer	-27.07863	153.36977	Brisbane City Council	1.19							
505 Cape Moreton	-27.02786	153.46691	Brisbane City Council	1.19							
506 St Helena (Noogoon)	-27.38949	153.23367	Brisbane City Council	1.55							
507 Thorneside	-27.48732	153.19751	Redland City Council	1.52						National Storm Tide Map	
508 Birkdale	-27.49126	153.21865	Redland City Council	1.52						National Storm Tide Map	
509 Wellington Point	-27.46591	153.24031	Redland City Council	1.51						National Storm Tide Map	
510 Ormiston	-27.51193	153.25585	Redland City Council	1.54						National Storm Tide Map	
511 Cleveland	-27.52698	153.26709	Redland City Council	1.54						National Storm Tide Map	
512 Victoria Point	-27.58170	153.31776	Redland City Council	1.55						National Storm Tide Map	
513 Redland Bay	-27.60064	153.31243	Redland City Council	1.55						National Storm Tide Map	

Map 12: Moreton Bay, Brisbane, Redlands and Gold Coast Coastlines cont.

Point Name	Lat.	Lon.	LGA	HAT (m) above AHD	Remarks	Date	Event	Reference Central Pressure (hPa)	Storm surge (m)	Storm Tide Level (m) AHD	Inundation Above HAT (m)
514 Lamb Island	-27.62618	153.37970	Redland City Council	1.54							
515 Coochiemudlo Island	-27.57037	153.33302	Redland City Council	1.54	National Storm Tide Map						
516 Karragarra Island	-27.63729	153.37007	Redland City Council	1.56							
517 Macleay Island	-27.61472	153.35672	Redland City Council	1.57							
518 Russell Island	-27.67530	153.38502	Redland City Council	1.57							
519 Peel Island (Turkrooar)	-27.49777	153.35532	Redland City Council	1.55							
520 North Stradbroke Island (Minjerriba)	-27.58880	153.45406	Redland City Council	1.48							
521 Dunwich	-27.49924	153.40246	Redland City Council	1.40							
522 Amity Point	-27.39526	153.44113	Redland City Council	1.22							
523 Flinders Beach	-27.39289	153.45905	Redland City Council	1.16							
524 Cylinder Beach	-27.42622	153.52579	Redland City Council	1.16							
525 Point Lookout	-27.43643	153.54569	Redland City Council	1.16							
526 Jumpinpin	-27.74203	153.43890	Gold Coast City Council	1.19							
527 Cabbage Tree Point	-27.73448	153.35806	Gold Coast City Council	1.44							
528 Jacobs Well	-27.78053	153.36211	Gold Coast City Council	1.29							

Map 12: Moreton Bay, Brisbane, Redlands and Gold Coast Coastlines cont.

Point Name	Lat.	Lon.	LGA	HAT (m) above AHD	Remarks	Date	Event	Reference Central Pressure (hPa)	Storm surge (m)	Storm Tide Level (m) AHD	Inundation Above HAT (m)
529 Hope Island	-27.86556	153.36112	Gold Coast City Council	1.10							
530 South Stradbroke Island	-27.83334	153.42227	Gold Coast City Council	1.15							
531 Tipplers Island	-27.78085	153.42977	Gold Coast City Council	1.10							
532 Couran	-27.82467	153.41234	Gold Coast City Council	1.05							
533 Currigee	-27.83333	153.43333	Gold Coast City Council	1.12							
534 Coombabah	-27.90004	153.38624	Gold Coast City Council	0.80							
535 Paradise Point	-27.88583	153.39445	Gold Coast City Council	1.05							
536 Hollywell	-27.90070	153.40135	Gold Coast City Council	1.12							
537 Anglers Paradise	-27.92533	153.39923	Gold Coast City Council	1.10							
538 Runaway Bay	-27.91191	153.39867	Gold Coast City Council	1.10							
539 Labrador	-27.94789	153.39833	Gold Coast City Council	1.11							
540 Southport	-27.96732	153.41451	Gold Coast City Council	1.21		29/01/1967	Dinah	945	1.5		
541 Gold Coast Seaway	-27.93582	153.42583	Gold Coast City Council	1.15		17/03/1993	Roger	985	0.7	1.3	
542 The Spit	-27.94646	153.42718	Gold Coast City Council	1.15							
543 Main Beach	-27.97834	153.42973	Gold Coast City Council	1.15							

Map 12: Moreton Bay, Brisbane, Redlands and Gold Coast Coastlines cont.

Point Name	Lat.	Lon.	LGA	HAT (m) above AHD	Remarks	Date	Event	Reference Central Pressure (hPa)	Storm surge (m)	Storm Tide Level (m) AHD	Inundation Above HAT (m)
544 Surfers Paradise	-28.00222	153.43141	Gold Coast City Council	1.15							
545 Broadbeach	-28.02250	153.43444	Gold Coast City Council	1.14							
546 Mermaid Beach	-28.04111	153.43805	Gold Coast City Council	1.14							
547 Miami	-28.06758	153.44469	Gold Coast City Council	1.14							
548 Burleigh Heads	-28.09169	153.45918	Gold Coast City Council	1.14							
549 Tallebudgera	-28.10002	153.46278	Gold Coast City Council	1.21							
550 Palm Beach	-28.11861	153.47278	Gold Coast City Council	1.13							
551 Currumbin	-28.13056	153.48861	Gold Coast City Council	1.13							
552 Tugun	-28.14222	153.49612	Gold Coast City Council	1.13							
553 Bilinga	-28.15472	153.50667	Gold Coast City Council	1.13							
554 Kirra	-28.16701	153.53218	Gold Coast City Council	1.13		7/02/1974	Pam	965	0.4		
555 Coolangatta	-28.16673	153.53746	Gold Coast City Council	1.13		21/02/1954		973	>1	2	



## Appendix E - Storm Tide Warning and Graphic Locations

For each location the following information is given:

- (a) Highest Astronomical Tide (HAT) above Australian Height Datum (AHD) or Mean Sea Level (MSL)
- (b) Theoretical Maximum Storm Tide (TMST) above Australian Height Datum (AHD).

Indicative TMST and HAT values provided are based on the nearest and highest TMST point value identified within the NDRP Storm Tide Hazard Interpolation Study, 2014.

Nearest Point (App D)	Name	Lat.	Lon.	Hat m AHD	TMST m AHD
1	Mornington Island	-16.67080	139.13700	1.91	6.00
8	Albert River	-17.50890	139.77800	2.81	10.00
11	Karumba	-17.45199	140.78900	2.70	15.00
17	Pormpuraaw	-14.91770	141.59000	1.88	8.00
19	Aurukun	-13.34950	141.60730	1.60	8.00
21	Weipa	-12.65480	141.81780	1.63	7.00
22	Mapoon	-11.96750	141.91500	1.63	8.00
32	Thursday Island	-10.58670	142.22000	2.09	7.65
35	St Pauls	-10.20000	142.33340	2.16	6.50
36	Kubin	-10.25000	142.21670	2.03	6.16
38	Boigu Island	-9.23330	142.20000	2.76	8.34
39	Dauan Island	-9.41660	142.55000	2.09	7.88
41	Ugar	-9.51660	143.53340	2.09	4.79
44	Iama	-9.90000	142.76670	2.14	4.84
58	Lockhart River	-12.81140	143.36710	1.72	9.40
67	Lizard Island	-14.65440	145.43710	1.58	3.56
74	Cooktown	-15.44390	145.24520	1.72	7.63
78	Bloomfield	-15.90620	145.36910	1.68	6.94
91	Port Douglas	-16.47960	145.48170	1.78	7.30
100	Palm Cove	-16.72520	145.68950	1.68	5.79
111	Cairns	-16.90350	145.78750	1.85	8.07
112	Green Island	-16.75390	145.97970	1.73	4.79
123	Yarrabah	-16.86820	145.88530	1.76	5.36
125	Flying Fish Point	-17.49360	146.07700	1.84	6.43
135	Clump Point	-17.84740	146.13370	1.90	7.07
145	Cardwell	-18.25430	146.04300	2.30	11.16
149	Lucinda	-18.51920	146.34640	2.12	8.69
152	Palm Island	-18.74010	146.54870	2.10	7.77
171	Nelly Bay	-19.17300	146.86380	2.10	9.77
179	Townsville	-19.23790	146.82410	2.23	11.23
189	Alva	-19.45410	147.48710	1.98	7.98

Nearest Point (App D)	Name	Lat.	Lon.	Hat m AHD	TMST m AHD
200	Molongle Creek	-19.82320	147.69080	1.98	10.46
203	Abbot Point	-19.86630	148.09300	1.97	8.22
209	Bowen	-20.02440	148.24290	1.96	8.53
212	Brisk Bay	-20.08900	148.29490	1.96	8.35
218	Dingo Beach	-20.08820	148.50950	1.99	7.86
225	Airlie Beach	-20.26370	148.70890	2.27	7.84
232	Hayman Is	-20.06070	148.88170	2.40	5.91
240	Hamilton Marina	-20.34240	148.94780	2.69	7.06
243	Conway Beach	-20.49170	148.76810	3.33	11.69
251	Laguna Quays	-20.59160	148.68350	3.46	12.60
280	Mackay	-21.14700	149.22340	3.68	11.07
288	Hay Point	-21.27730	149.30740	3.81	11.12
307	St Lawrence	-22.29180	149.60410	5.07	14.71
312	Broad Sound	-22.51110	149.95040	5.10	15.64
318	Shoalwater Bay	-22.55200	150.56120	4.40	11.04
328	Great Keppel Island	-23.19480	150.91670	2.64	8.42
329	Yeppoon	-23.13340	150.78640	2.78	9.93
347	Port Alma	-23.58090	150.85720	3.04	11.93
354	Gladstone	-23.83630	151.26820	2.50	9.04
370	Agnes Water	-24.19210	151.91070	1.96	6.21
381	Burnett Heads	-24.78780	152.45610	2.00	6.90
407	Urangan	-25.27700	152.89540	2.28	8.90
434	Rainbow Beach	-25.89980	153.11440	1.25	4.96
436	Cooloola Beach	-26.06640	153.14570	1.21	4.46
442	Noosa Heads	-26.35500	153.09190	1.16	4.52
457	Mooloolaba	-26.67910	153.13060	1.18	4.45
468	Golden Beach	-26.82220	153.12620	1.07	4.42
483	Scarborough Boat Harbour	-27.19160	153.10600	1.27	4.86
496	Brisbane River	-27.37570	153.16170	1.53	5.61
513	Redland Bay	-27.60580	153.30750	1.56	6.20
540	Southport	-27.95410	153.41590	1.15	4.10
543	Main Beach	-27.96600	153.43570	1.15	4.08
555	Coolangatta	-28.16400	153.53000	1.13	3.98

## Appendix F - Useful Storm Tide References

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## Appendix G - Useful Web Sites

Australian Bureau of Meteorology – Tropical Cyclone Advices and Track Maps

<http://www.bom.gov.au/weather/cyclone>

Australian Bureau of Meteorology – Storm Surge Preparedness and Safety

<http://www.bom.gov.au/cyclone/about/stormsurge.shtml>

*Disaster Management Act 2003*

<http://www.legislation.qld.gov.au/LEGISLTN/ACTS/2003/03AC091.pdf>

Disaster management arrangements in Queensland

[http://www.disaster.qld.gov.au/About\\_Disaster\\_Management/DM\\_arrangments.html](http://www.disaster.qld.gov.au/About_Disaster_Management/DM_arrangments.html)

Queensland Evacuation Guidelines

[http://www.disaster.qld.gov.au/Disaster-Resources/Documents/2907EMQ\\_SDMG\\_QLD\\_Evac%20Guide\\_web.pdf](http://www.disaster.qld.gov.au/Disaster-Resources/Documents/2907EMQ_SDMG_QLD_Evac%20Guide_web.pdf)

Disaster Management Strategic Policy Framework

[http://www.disaster.qld.gov.au/Disaster-Resources/Documents/Disaster\\_Management\\_Strategic\\_Policy\\_Framework.pdf](http://www.disaster.qld.gov.au/Disaster-Resources/Documents/Disaster_Management_Strategic_Policy_Framework.pdf)

Emergency Management Australia

<http://www.ag.gov.au/emergencymanagement/Pages/default.aspx>

Queensland Fire and Emergency Services

<https://www.qfes.qld.gov.au/>

National Storm Tide Mapping Model for Emergency Response

<http://www.disaster.qld.gov.au/Disaster-Resources/Documents/Final%20Report%2029%20May%2003.pdf>

Queensland Natural Disaster Relief and Recovery Arrangements

[http://disaster.qld.gov.au/Financial%20Support/Documents/Queensland\\_Disaster\\_Relief\\_and\\_Recovery\\_Arrangements\\_Guidelines2.pdf](http://disaster.qld.gov.au/Financial%20Support/Documents/Queensland_Disaster_Relief_and_Recovery_Arrangements_Guidelines2.pdf)

Queensland Climate Change and Community Vulnerability to Tropical Cyclones report series (2004)

<http://www.longpaddock.qld.gov.au/about/publications/vulnerabilitytocyclones/index.html>

Standard Emergency Warning Signal Guidelines

<http://www.disaster.qld.gov.au/Disaster-Resources/Documents/Standard%20Emergency%20Warning%20Signal%20SEWS.pdf>

State Disaster Management Group Annual Reports

<http://www.disaster.qld.gov.au/Disaster-Resources/Reports.html>

State Emergency Services

[www.emergency.qld.gov.au/ses](http://www.emergency.qld.gov.au/ses)

Storm Tide Gauge Network – Department of Science, Information Technology, Innovation and the Arts

<http://www.qld.gov.au/tides>

Tropical Cyclone Tracking Map

<http://www.bom.gov.au/cyclone/about/plotting.shtml>

Wave monitoring - Department of Department of Science, Information Technology, Innovation and the Arts <http://www.qld.gov.au/waves>

## Appendix H - Maps and Figures Contained in this Document

### Maps

Page No.	Map No.	Map Title
32	1	The Gulf of Carpentaria Coastline.
34	2	Cape York Coastline.
39	3	Cairns Coastline.
43	4	Cassowary Coastline.
46	5	Hinchinbrook, Townsville and Burdekin Coastlines.
51	6	Whitsunday Coastline.
56	7	Mackay Coastline.
61	8	Isaac and Rockhampton Coastlines.
65	9	Gladstone Coastline.
68	10	Bundaberg and Fraser Coast Coastlines.
73	11	Gympie and Sunshine Coast Coastlines.
77	12	Moreton Bay, Redlands and Gold Coast Coastlines.

### Figures

Page No.	Figure No.	Figure Title
7	1a	Depiction of 'normal' high tide, and a 'storm tide'.
7	1b	Time series of a typical storm tide.
8	2	Queensland Disaster Management Arrangements structure.
10	3	Agency relationships within Queensland's disaster management arrangements.
13	4	Sample Tropical Cyclone Forecast Track Map.
15	5	Storm Tide Warning-Response System timeline.
16	6	Sample Storm Tide Warning Graphic.
17-18	7	An example of a Storm Tide Warning.
25	8a	Semidiurnal tidal planes.
25	8b	Diurnal tidal planes.
26	9	DSITI Storm Tide Gauge Network and Wave Buoy Locations.
30	10	Sample forecast track map showing 72 and 120 hour forecast positions as displayed in the Bureau's Meteye viewer.





# Tropical Cyclone Storm Tide Warning

Queensland quick reference guide  
2015/16 wet season



Queensland Tropical Cyclone Storm Tide Warning—Response System Handbook (12th edition, 2015)

**Earlier issue of Storm Tide Warnings**—now issued in conjunction with first declaration of a cyclone watch zone, giving up to 48 hours' notice. [Storm Tide Standby Bulletin no longer issued.](#)

## Storm Tide Warning

Issued at 5:24 am EST on Thursday 19 March 2015.

**NOT FOR DIRECT RELEASE TO THE MEDIA OR THE GENERAL COMMUNITY**

**FOR URGENT ATTENTION**

- State Disaster Coordination Centre (SDCC)
- District Disaster Coordinators at: CAIRNS
- Local Government Offices in the threatened zone

**FOR INFORMATION**

- Police Communications Centre Brisbane
- QFES Regional Directors in the threatened zone

Example Only

## SITUATION

Severe Tropical Cyclone *Noname*, category 3, is moving westwards towards the coast. The system is expected to develop into a category 4 system during Thursday and cross the coast between Cape Melville and Cape Tribulation on Friday morning. The worst case scenarios allow for the cyclone to intensify slightly more than expected, and slow down, such that the landfall is closer to or on Friday morning's high tide. Worst case predictions for locations south of Cooktown assume a crossing well to the north but inside the grey zone indicated on the forecast track map. In all cases the highest water level is expected to occur with Friday morning's high tide rather than at coastal crossing time.

**Worst case scenario definition change**—see note 1 overleaf, and paragraph 3.9 of the 2015 handbook.

## STORM TIDE: WORST CASE SCENARIO

Storm tide = normal tide + storm surge + wave setup

Location	Tide (m above LAT)	Storm Surge (m)	Wave Setup (m)	Storm Tide (m above LAT)	Storm Tide (m above AHD)	Storm Tide (m above HAT)
Cooktown	3.0m 8:52 AM 20 Mar	2.0	0.5	5.5	4.0	2.3
Port Douglas	3.2m 8:55 AM 20 Mar	1.2	0.3	4.7	3.2	1.4
Cairns	3.3m 9:05 AM 20 Mar	0.9	0.3			

Compare the **worst case** and **forecast track** scenario estimates for a location to assess range of possibilities.

**Forecast track scenario remains unchanged**—see paragraph 3.10 of the 2015 handbook.

## STORM TIDE: FORECAST TRACK SCENARIO

Location	Tide (m above LAT)	Storm Surge (m)	Wave Setup (m)	Storm Tide (m above LAT)	Storm Tide (m above AHD)	Storm Tide (m above HAT)
Cooktown	3.0m 8:43 AM 20 Mar	0.3	0.2	3.5	2.0	0.3
Port Douglas	3.2m 8:55 AM 20 Mar	0.2	0.2	3.6	2.0	0.2
Cairns	3.3m 9:00 AM	0.2	0.1	3.6	2.0	0.1

**Increased number of warning locations**—up to 10, from 11st agreed pre-season.

**Wave setup** in its own column for ease of reading.

**Three reference datums**—storm tide heights are listed relative to all three commonly used reference datums (LAT, AHD and HAT).



**Onset of damaging winds**—range of times now provided, from earliest expected time, to time associated with the forecast track scenario.

**Update frequency**—Issued six-hourly during cyclone watch stage but no more than three-hourly during cyclone warning stage. See paragraph 3.12 of the 2015

**Notes**

1. The "Worst Case Scenario" storm tide heights are based on the locations in question experiencing a combination of conditions, within the bounds of forecast uncertainty, to produce a larger storm tide from a slightly more intense cyclone with a centre within the range of possibilities as depicted by the grey area on the most recent TC Forecast Track Map. Generally this would mean the cyclone impacting close to the location, such that it experiences maximum onshore winds at a time near to or at the local high tide. The storm surge and storm tide figures presented in this table generally do not represent the most likely outcome, which is represented by the "Forecast Track Scenario".
2. The contribution due to wave set-up has been included. Storm tide = normal tide + storm surge + wave setup.
3. The additional contribution due to wave run-up has not been included. See para 3.25 of the Handbook.
4. LAT is the Lowest Astronomical Tide (published tide tables use this reference datum)
5. HAT is the Highest Astronomical Tide
6. AHD is the Australian Height Datum

**ONSET OF DAMAGING WINDS**

Wind gusts expected to exceed 100 kilometres per hour are expected at:

Location	Earliest Onset Time (local)	Forecast Track Onset Time (local)
Cooktown	19 Mar 2:00 PM	19 Mar 8:00 PM
Port Douglas	19 Mar 5:00 PM	19 Mar 10:00 PM
Cairns	20 Mar 3:00 AM	Not expected

Example Only

**Observed Tides**

See [www.qld.gov.au/tides](http://www.qld.gov.au/tides)  
The next Storm Tide Warning will be issued by 9am EST Thursday 19 March 2015.

Further details are available from the following sources:

1. Tropical Cyclone forecasts and warnings  
QFES Meteorologist - Telephone (07) 3635 xxxx / (07) 3239 xxxx  
Bureau of Meteorology - Telephone (07) 3239 xxxx
2. Technical aspects of the Storm Tide  
SDCC(DSITI) - Telephone 04xx xxx xxx  
Telephone numbers are restricted to official use only.

Further information on technical considerations and local effects can be found in the Tropical Cyclone Storm Tide Warning—response system handbook at:  
<http://disaster.qld.gov.au/Disaster-Resources/Documents/Storm-Tide-Handbook.pdf>

## Tropical Cyclone Storm Tide Warnings—location list for 2015/16 season

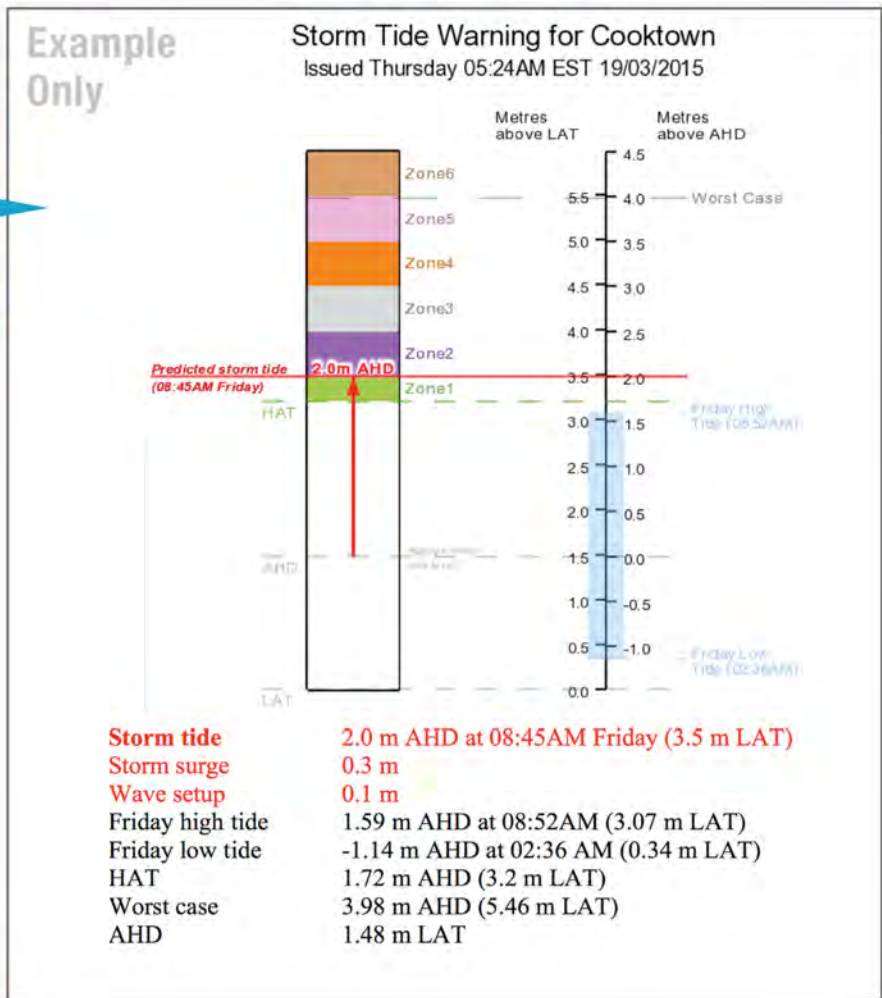
Up to ten locations from the list below may be included in a Tropical Cyclone Storm Tide Warning. Each location will also have an associated storm tide graphic.

Additional location details are available in Appendix E of the handbook.

Districts						
Mount Isa	Cairns	Innisfail	Townsville	Mackay	Rockhampton	Gladstone
Mornington Island	Pompuraaw	Flying Fish Point	Lucinda	Abbot Point	Broad Sound	Gladstone
Karumba	Aurukun (Archer River)	Clump Point	Palm Island	Bowen	Shoalwater Bay	Agnes Water
Albert River	Weipa	Cardwell	Townsville	Brisk Bay	Yeppoon	
	Mapoon		Nelly Bay	Dingo Beach	Great Keppel Island	
	Thursday Island		Alva	Airlie Beach	Port Alma	
	Moa-Kubin		Molongle Creek	Conway Beach		
	Moa-St Pauls			Hayman Island		
	Boigu			Hamilton Island		
	Dauan			Laguna Quay		
	Ugar			Mackay		
	Iama			Hay Point		
	Lockhart River			St Lawrence		
	Lizard Island					
	Cooktown					
	Bloomfield					
	Port Douglas					
	Palm Cove					
	Cairns Harbour					
	Green Island					
	Yarrabah					
Bundaberg	Maryborough	Gympie	Sunshine Coast	Redcliffe	Brisbane	Gold Coast
Burnett Heads	Urangan	Rainbow Beach	Noosa Heads	Scarborough Boat Harbour	Brisbane River	Southport (inside Broadwater)
		Coolooloa Beach	Mooloolaba		Redland Bay	Main Beach
			Golden Beach			Coolangatta Beach



**Storm Tide Warning graphics now available for each warning location**—access via State Disaster Coordination Centre (SDCC) registered user web page ([reg.bom.gov.au](http://reg.bom.gov.au)). Contact SDCC for username and password.

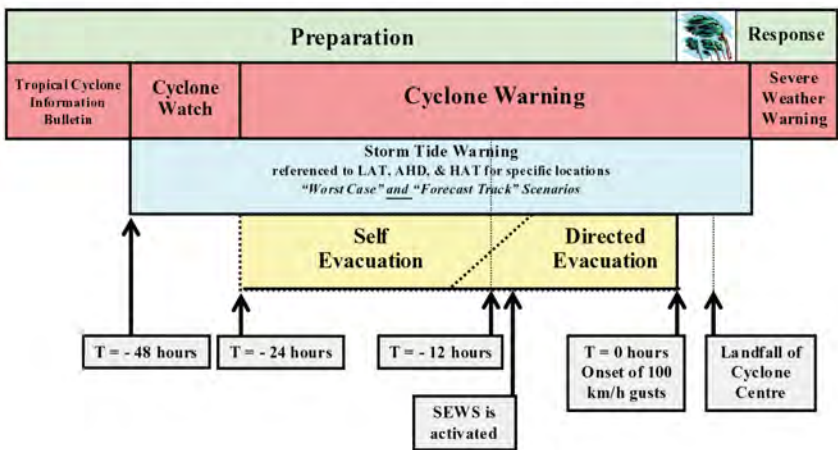


The storm tide warning response system remains directly linked to the tropical cyclone warning system. This diagram shows how the two systems work together.

### Storm Tide Warning – Response System

**Storm Tide = Storm Surge + Normal Tide + Wave Setup**

Although the warning issue timeline is based on the forecast onset of 100 km/h wind gusts, a more flexible approach is adopted in practice to avoid conducting directed evacuations at night.



**CONTACT US:**

[www.bom.gov.au/other/feedback](http://www.bom.gov.au/other/feedback)

[QLDSevereWeather@bom.gov.au](mailto:QLDSevereWeather@bom.gov.au)