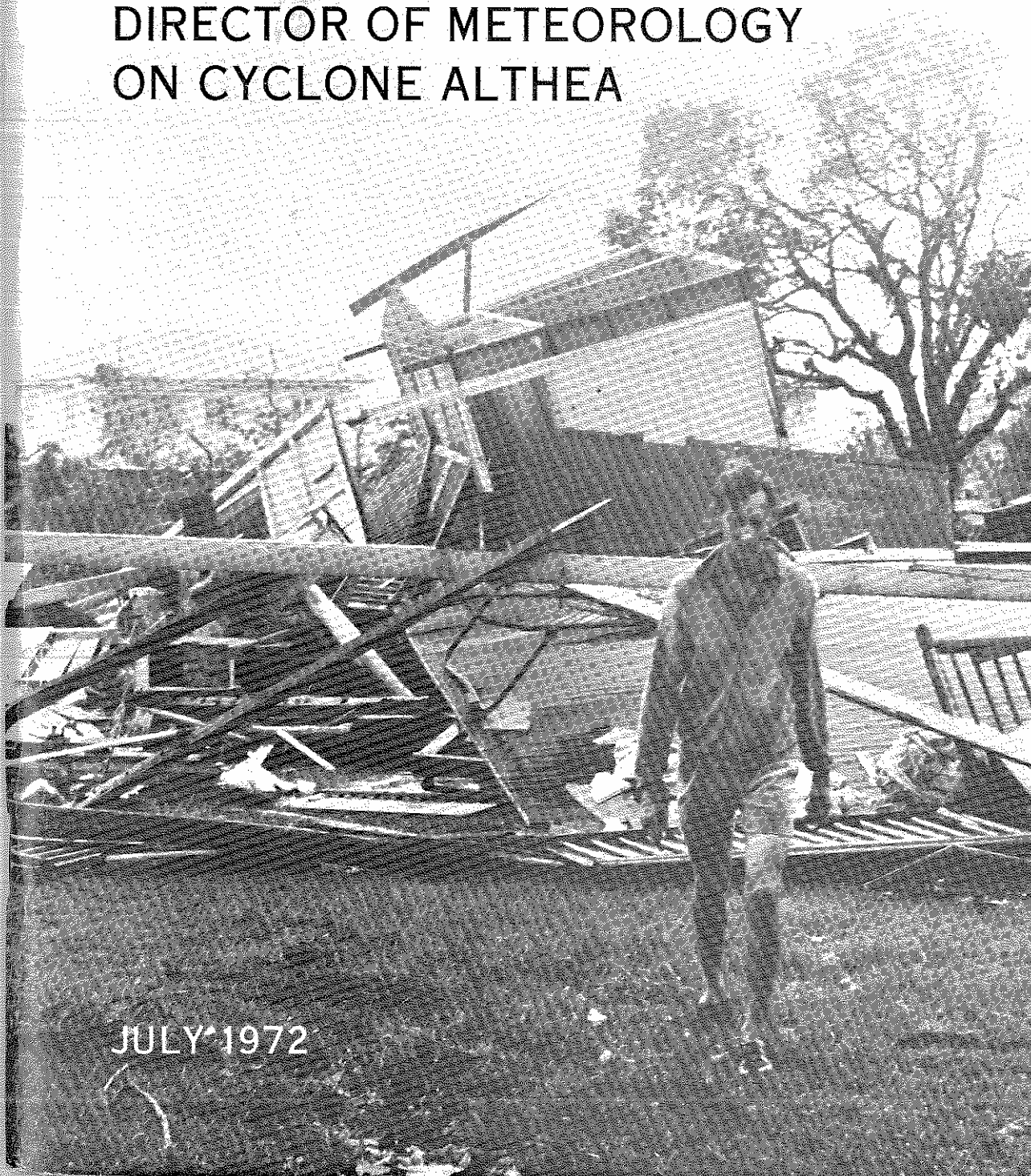




BUREAU OF METEOROLOGY

DEPARTMENT OF THE INTERIOR

REPORT BY
DIRECTOR OF METEOROLOGY
ON CYCLONE ALTHEA



JULY 1972



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and
published by the Australian Government Publishing Service

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officers of the Bureau of Meteorology.

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in this report.

Commonwealth Printing Unit, Melbourne.



BUREAU OF METEOROLOGY

DEPARTMENT OF THE INTERIOR

The Honourable Ralph J. Hunt, M.P.,
Minister of State for the Interior,
Commonwealth of Australia

This report on Cyclone "Althea" records the history of the cyclone and its impact on the community. Although "Althea" was one of the most intense cyclones to strike the Queensland coast for many years the loss of life was comparatively small. On the other hand the damage to property was considerable, being conservatively estimated at \$25 million.

If it were not for the outstanding performance of officers of the Bureau's Tropical Cyclone Warning Centre in Brisbane and its Townsville office the loss of life and property would certainly have been greater. Nevertheless, community preparedness, which the Bureau has fostered since Cyclone "Ada" in 1970, still requires considerable attention.

The concern of the tourist industry that unfavourable publicity for northern Queensland results from such efforts can be allayed by publicising the fact that the frequency of cyclones in this area is low and provided the tourist is aware of the nature of the cyclones and the warning system there is no real danger.

(W. J. GIBBS)
Director of Meteorology

31 July, 1972.

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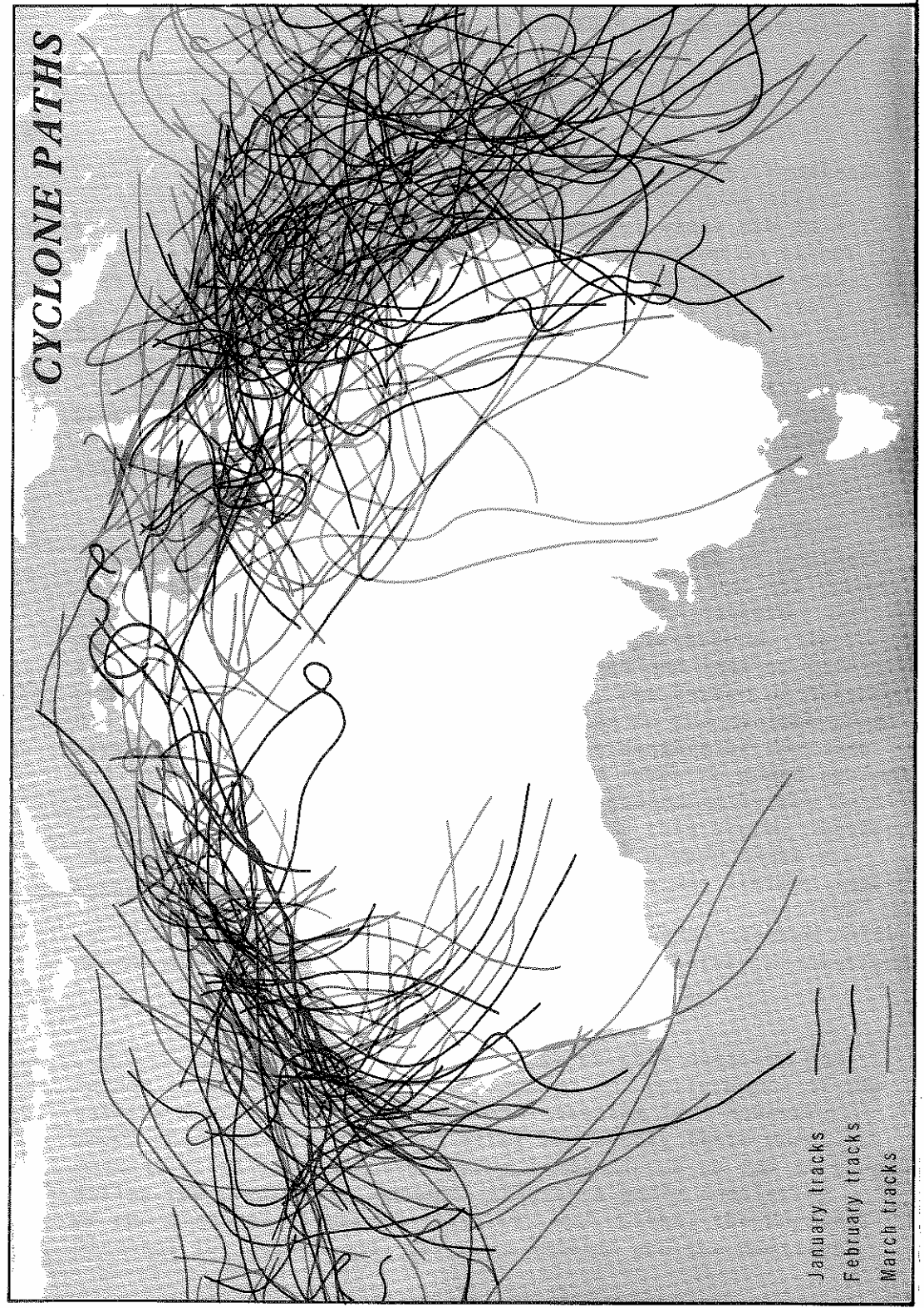


Fig 1 This map shows all tropical cyclones which affected Australia in January, February and March during the years 1910 - 1969 (north-east coast, and 1930 - 1969 (north-west coast). An examination reveals that, although some cyclones followed a path which was roughly parabolic, the tracks are generally random.

REPORT BY DIRECTOR OF METEOROLOGY ON ON CYCLONE ALTHEA

INTRODUCTION

In most years during the summer months, tropical cyclones occur over the Coral Sea and some of these affect the coast of Queensland. The most powerful winds are in a relatively narrow band usually about twenty miles on either side of the centre. However, damage can be caused by wind, waves and rainfall up to two hundred miles from the "eye". Between Cooktown and Townsville any particular locality in the coastal strip may expect to experience severe cyclonic effects with an average frequency of once in three years, between Bowen and Mackay, once in five years; between Rockhampton and Brisbane once in eight years. The chances of being directly in the track of the centre are naturally much less.

Townsville, which was last visited by the full force of a cyclone in March 1956, lay in the path of another named "ALTHEA" towards the end of December 1971 but the towns-people were better prepared, more aware of the dangers approaching than they had been on previous occasions. As a result of investigations into the damage and loss of life caused by cyclone "ADA" in January 1970, the Bureau of Meteorology had mounted a public information campaign in the cyclone-prone areas to alert the general public to the dangers of cyclones and to advise what precautions should be taken to guard against them. The value of the campaign was demonstrated by the behaviour of the population before, during and after this storm. Obviously, the tremendous energy of such a storm will always cause a considerable amount of damage but the damage was limited in this case by timely warning and preparedness. Cyclone "ADA" in 1970 killed thirteen people. Cyclone "ALTHEA" caused three deaths and in none of these was ignorance of safety precautions a contributing factor.

The Bureau of Meteorology on this occasion has reason to view with great satisfaction the performance of its warning system and of the personnel manning it. However, among the laudatory comments after the event, there were several criticisms and these were investigated as far as possible during the period 5-7 January 1972 by a party consisting of the Director of Meteorology, Dr. W.J. Gibbs, the Regional Director for Queensland, Mr. A.J. Shields and the Assistant

One of the features of tropical cyclones about which little is known but which had been given considerable prominence in the Bureau's public education campaign is the storm surge, a general increase in sea level caused partly by the winds driving the seawater shorewards as the cyclone approaches the coast, partly by the low atmospheric pressure at the storm centre. Along any coastline, this may cause the water to rise well above high-tide level. In this case the storm surge produced a sea level nine foot higher than normal and as a result, sea water from the Ross River covered the main street of Townsville. Such a storm surge, if it coincided with a spring high tide at a town like Mackay would cause incalculable damage and probably serious loss of life.

Inspections of the damage indicated that special minimum building standards are desirable for cyclone-prone regions. Certain building materials such as tiles and sheets of iron if not securely anchored, become dangerous missiles when they are torn loose by high winds. In a densely populated area such as Townsville, the dangers are multiplied.*

Much of the material damage resulting from a cyclone is generally due to the accompanying rainfall and consequent flooding. The rainfall associated with "ALTHEA" was, under the circumstances, not particularly heavy in Townsville but larger falls occurred after the storm centre had passed the coast. In Townsville, 589 points were registered up to 9 am on 24 December, 364 points in the following 24 hours and 233 the next day. Rainfall of such severity, cascading through damaged roofs and exterior walls of homes, business premises and store-rooms caused extensive damage to furniture, interior walls, electrical wiring and stored goods of many types.

* It is of interest to note that, as a consequence of the great damage caused in the Philippines by typhoons in October and November 1970, a regional seminar on "Wind Effects on Buildings and Structures" was organised in Manila by UNESCO and WMO in November 1971. As a result of this meeting, revised building codes are being developed in the Philippines.

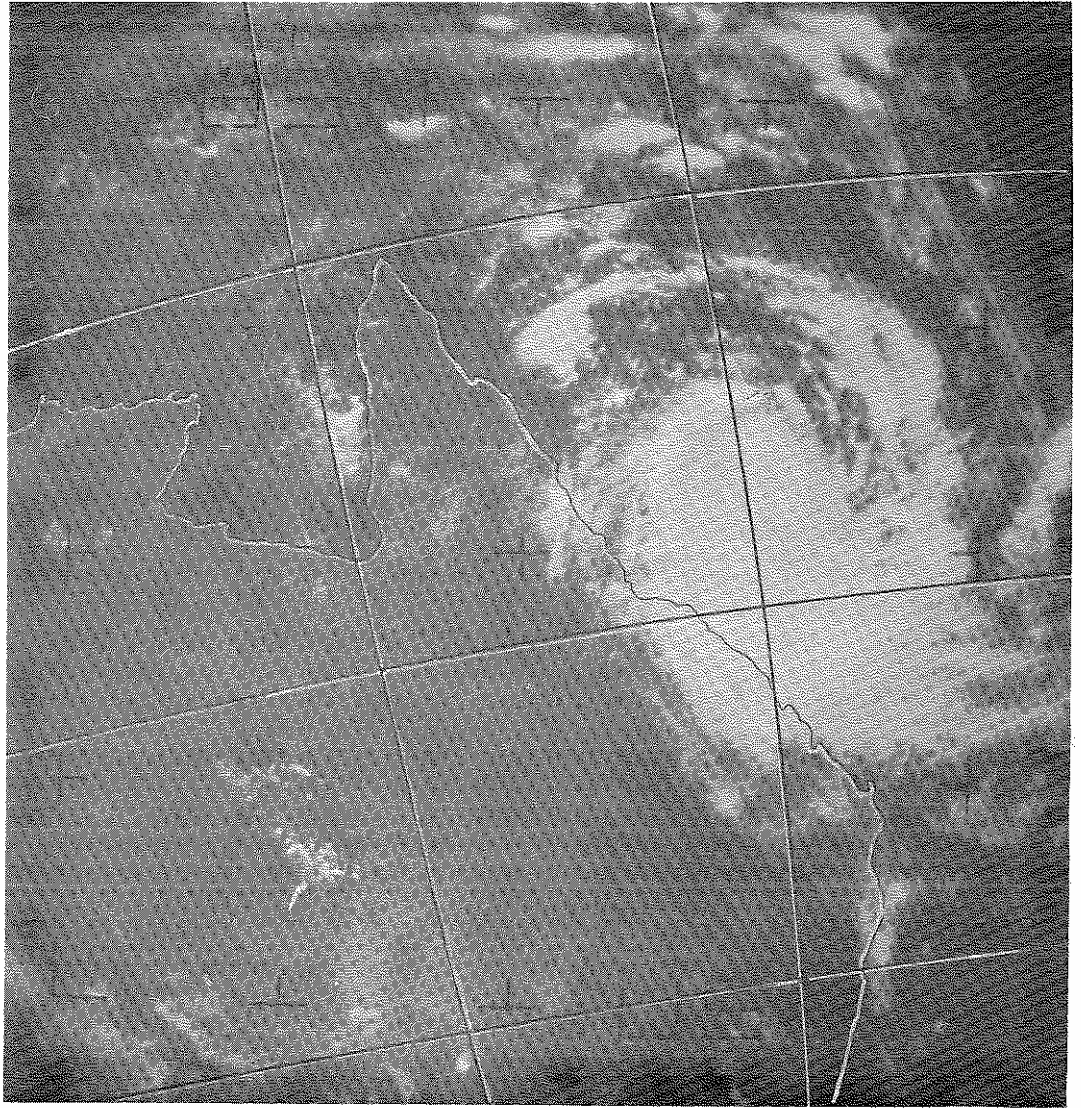


Fig 2 A photograph of ALTHEA taken by the U.S. meteorological satellite ESSA 8, just before 11 a.m. (DST) on 23 December. No "eye" is visible in this satellite photograph, probably because a layer of high cloud has obscured it but the feature showed up clearly in the radar photographs of rain echoes.

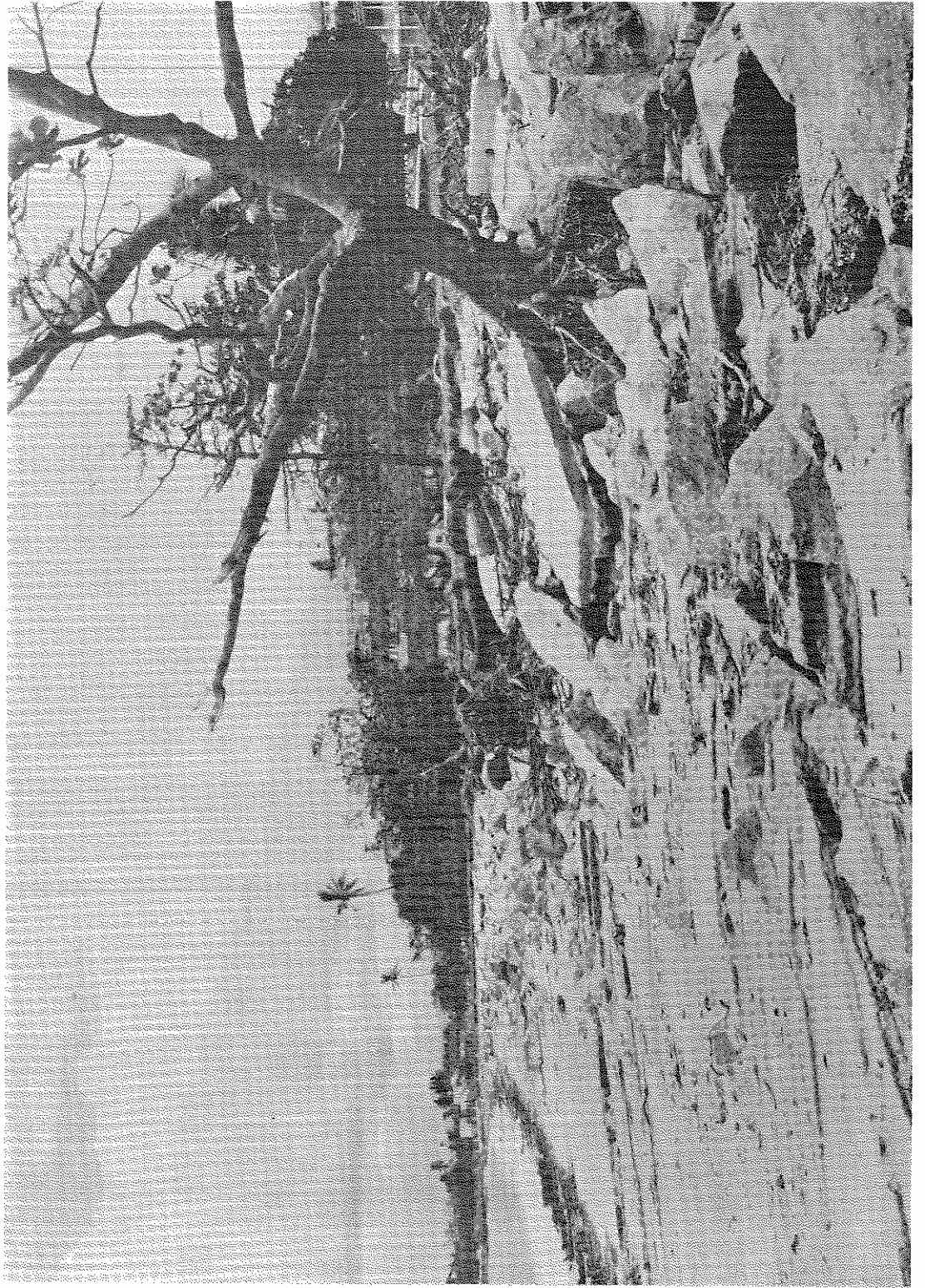


Fig 3a The hammering of the waves during the storm surge demolished the sea wall along the Strand.

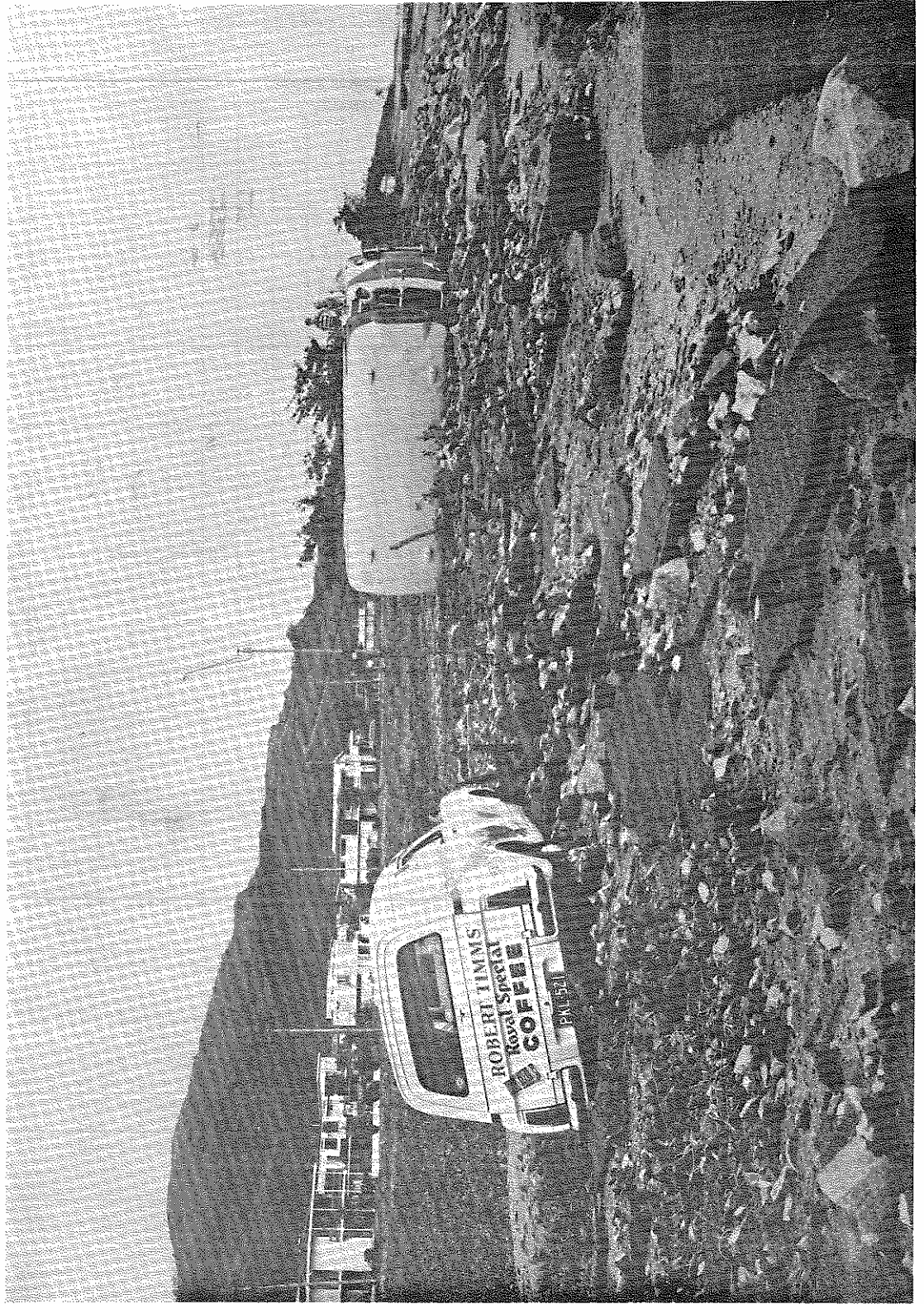


Fig 3b Powerful wave action during the storm surge destroyed much of the bitumen road along the main sea-front road at Pallarenda and swept a number of vehicles from the road. At the height of the storm surge houses in the background were flooded by sea water to a depth of about two feet.

STORM SURGE TOWNSVILLE 24 DEC 1971
ASSOCIATED WITH CYCLONE "ALTHEA"

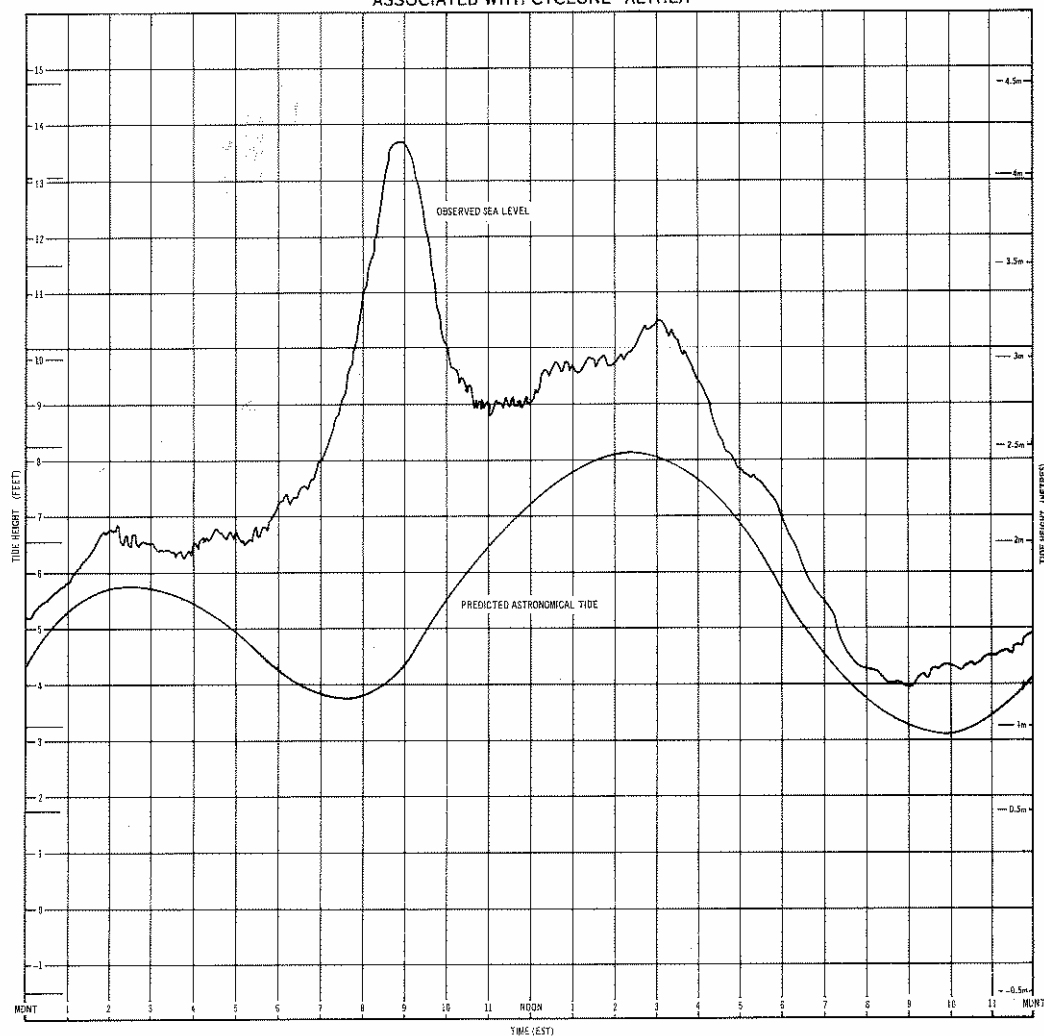


Fig 4 The predicted tide level and the actual heights measured by the Townsville harbour gauge on 24 December 1971. The high water resulted from the 'storm surge', a general increase in sea level caused partly by winds driving the water shorewards as the cyclone approaches the coast, partly by the low atmospheric pressure at the storm centre. In this case it may be seen that at about 9 am EST on 24 December sea level was about nine feet higher than it would have been under normal circumstances and about six feet higher than high tide level. If the arrival of the storm surge had been some 5 or 6 hours later, coinciding with high tide, damage would have been even greater.

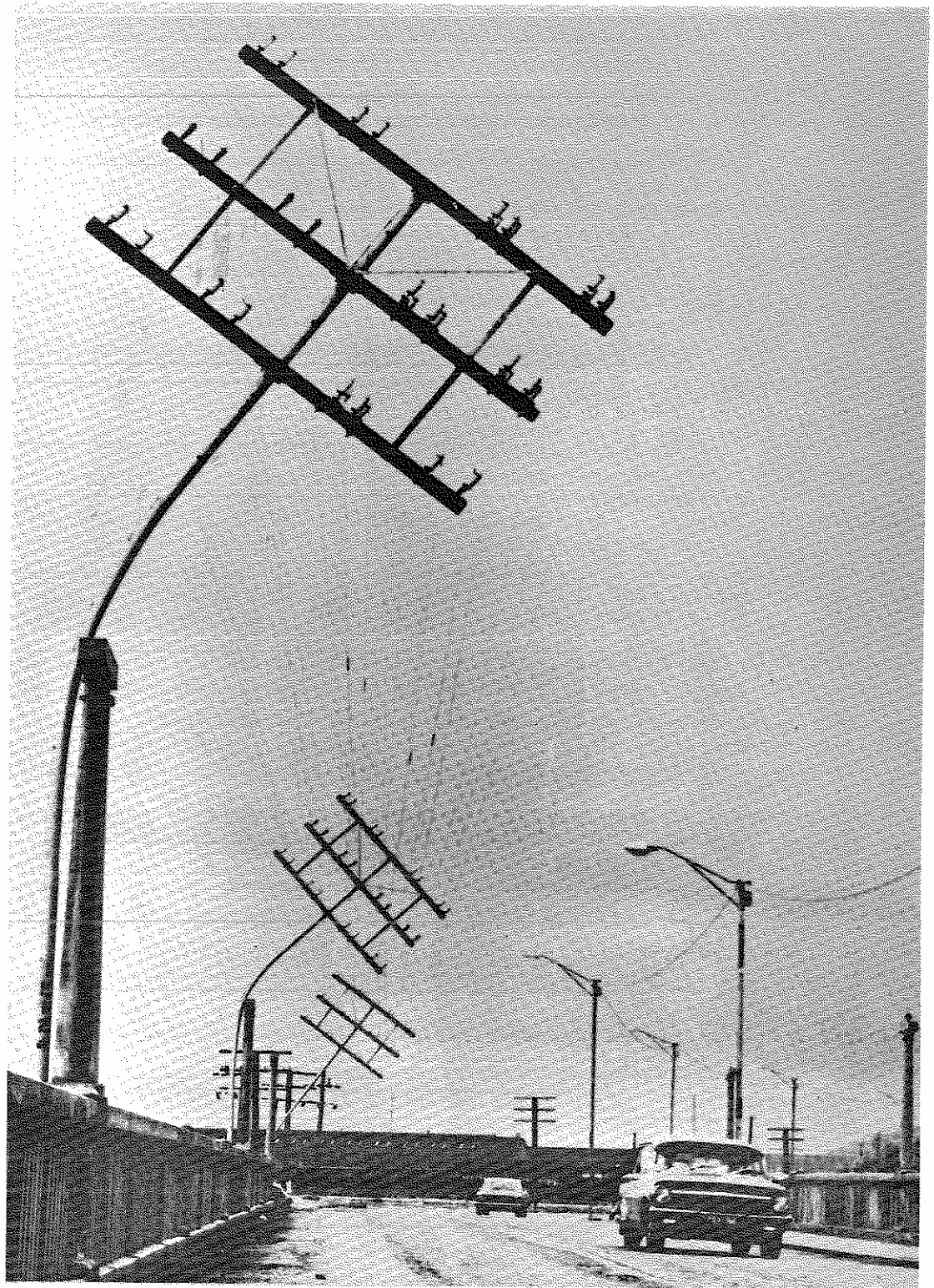


Fig 5 The force of the winds produced by ALTHEA is graphically illustrated by what has happened to these heavy steel poles.

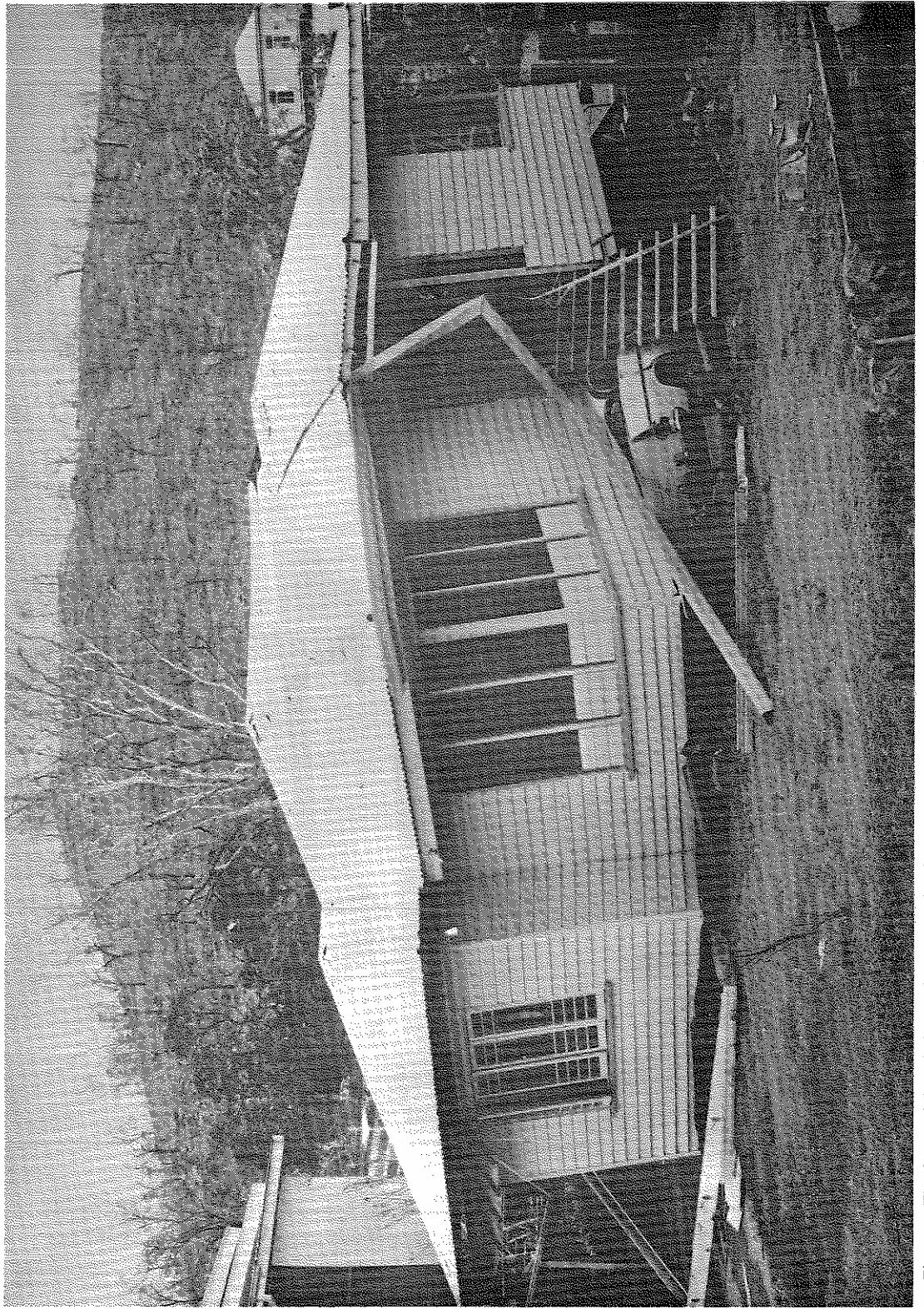


Fig 6a The force of the wind has almost completely stripped the leaves from the trees on the exposed parts of the hill behind this seriously damaged house in Stagpole Street, West End. Note that the house has been lifted off its stumps and dumped on the car garaged below.

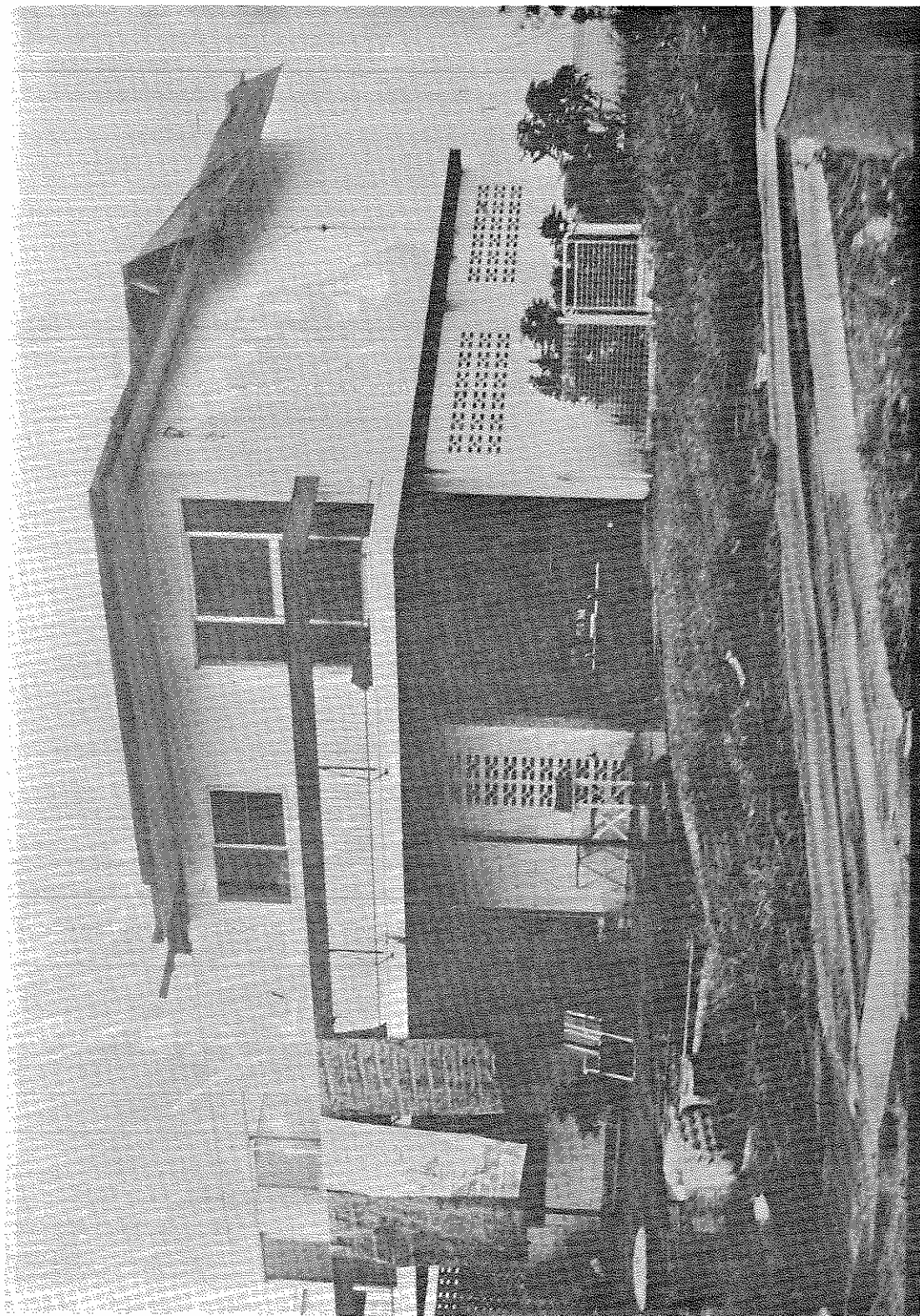


Fig 6b Hundreds of roofs in Townsville needed repairs after the cyclone but interior damage was even greater. Rain water spoiled furniture and other personal possessions. In many cases interior walls and electrical wiring had to be replaced.

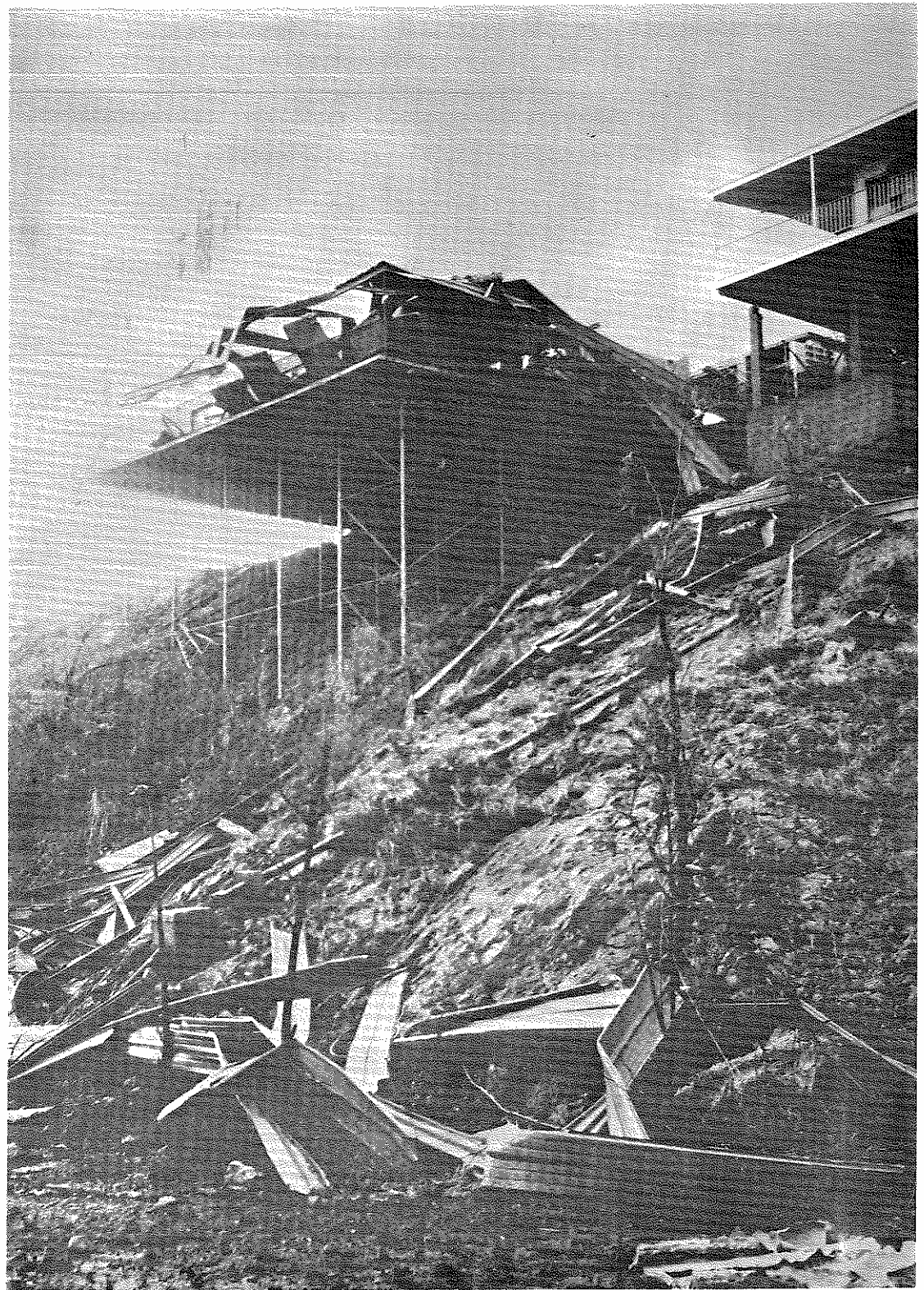


Fig 6c This newly constructed house in Yarrowonga, a seaside suburb of Townsville, is typical of a number of others nearby which suffered extensive damage.

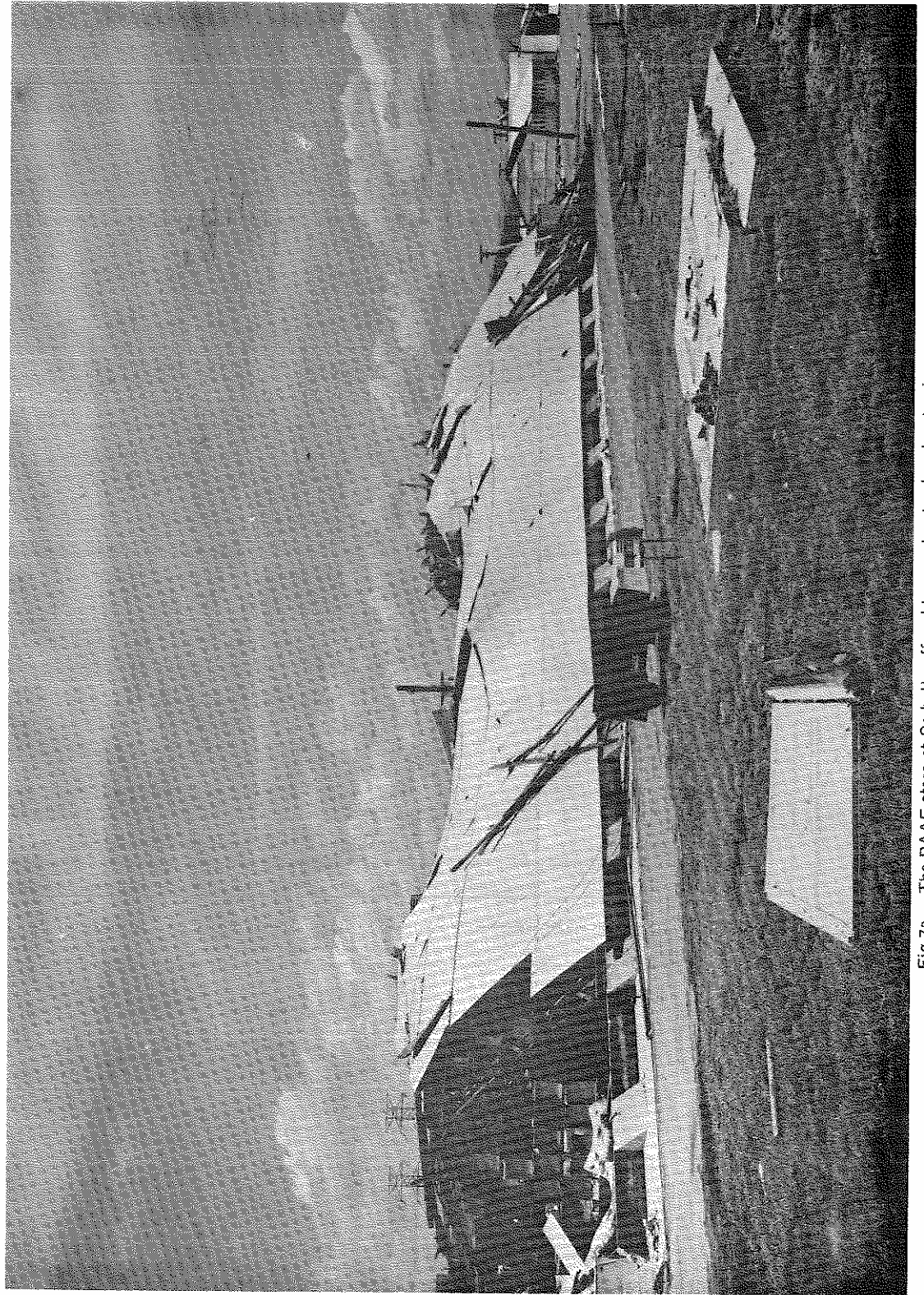


Fig 7a The RAAF store at Garbutt suffered heavy structural and water damage.

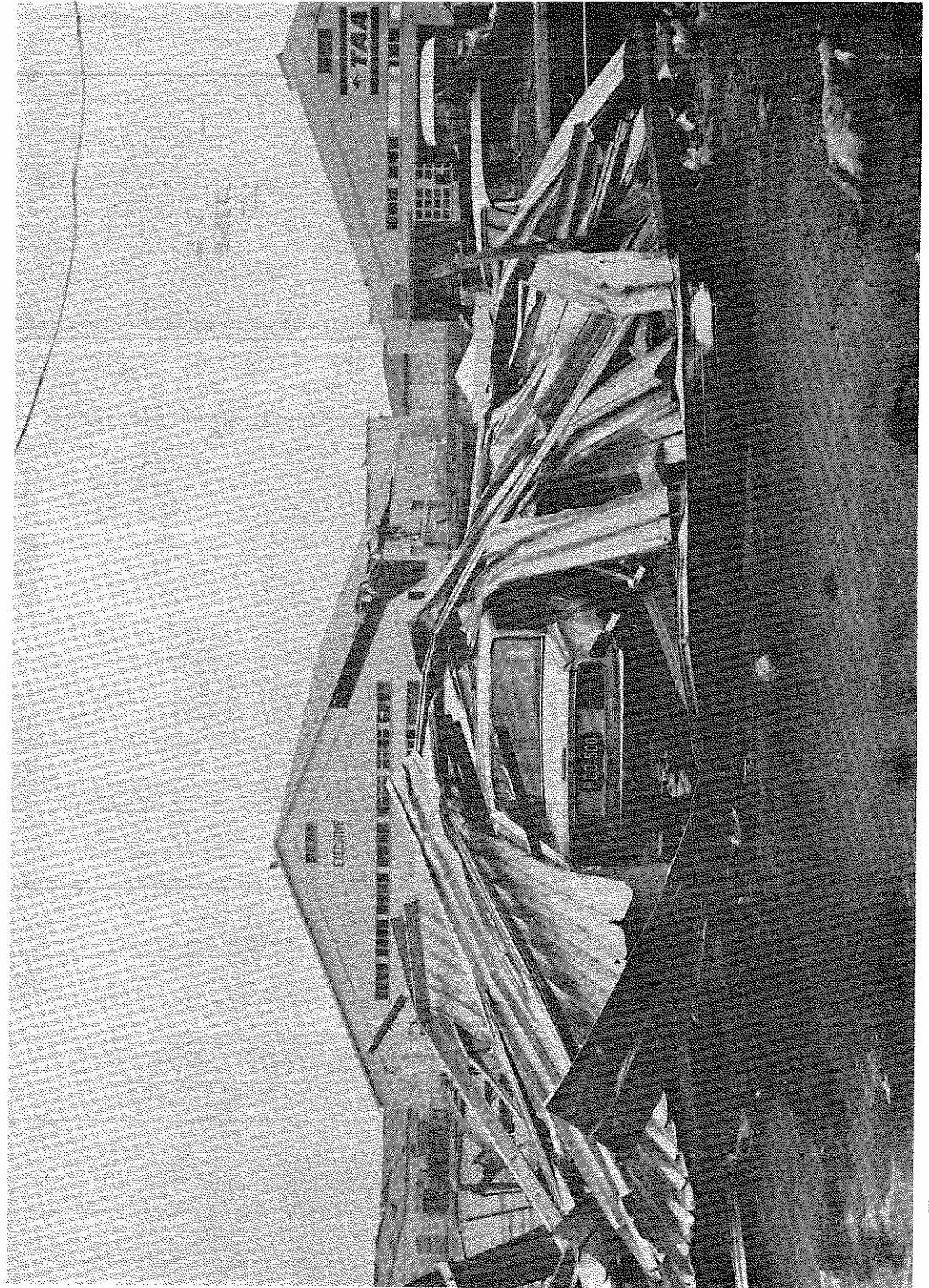


Fig 7b A scene at the airport. A nearby building was unroofed and the debris landed on a number of parked cars which were seriously damaged.

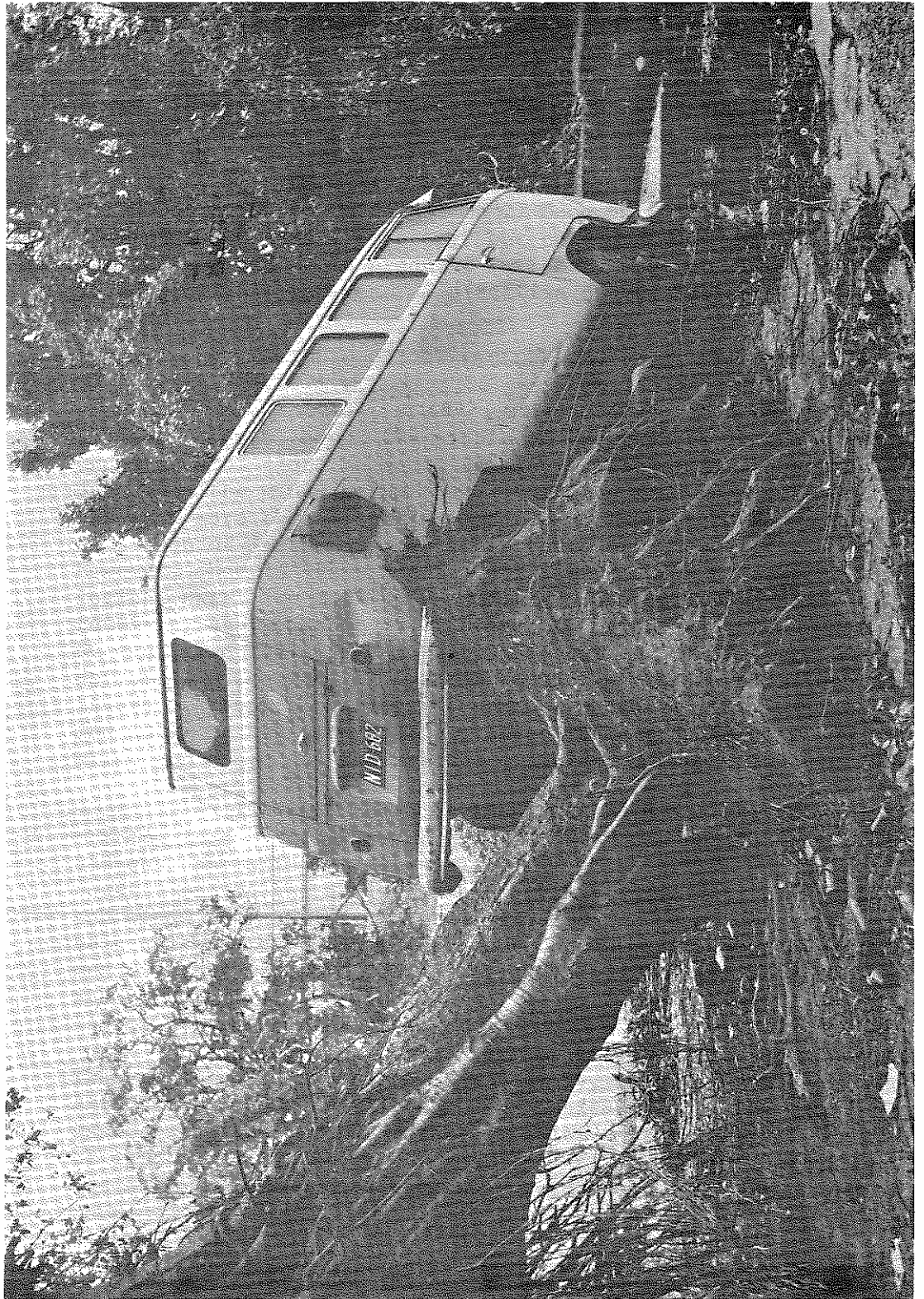


Fig 7c This tree in Palmer Street, Townsville which has resisted many powerful winds over the years succumbed to ALTHEA's heavy gusts

As the centre moved inland, although winds abated, heavy rains of up to 10 inches in 12 hours marooned several townships and forced hundreds of families to evacuate their homes. Damage due to flooding in inland towns and properties amounted to hundreds of thousands of dollars.

By the time the cyclone recrossed the coast near Maryborough towards midnight on 27 December, it had lost a great deal of its destructive energy but once over the sea, it regenerated and again produced extremely violent winds as it moved slowly in the general direction of New Zealand.

HISTORY OF CYCLONE "ALTHEA"

In the hot, steamy atmosphere of the ocean near the Solomon Islands, about the middle of December, a larger than usual area of cloud began to develop horizontally and vertically. Just when the winds below this cloud mass rose to a strength somewhat more than a tropical breeze will never be known because no person or instrument was there to record these facts. However, once in every twenty-four hours, the U.S. meteorological satellite ESSA 8 transmitted a photograph to Australian receiving stations and by 21 December, meteorologists of the Bureau's Tropical Cyclone Warning Centre at Brisbane saw definite indications of a strengthening of the circulation and issued a "tropical advisory", warning meteorological offices and local authorities of the presence of a tropical low 250 miles southwest of Honiara which could develop into a cyclone.

The shot taken as ESSA flashed by on the following morning left no room for doubt: "ALTHEA" was developing force and was continuing to move in the direction of the Queensland coast. During the day, pressure at the centre fell gradually and winds intensified. Since early morning heavy seas had been crashing over Lihou Reef where an automatic weather station measured and reported falling pressure and changes in force and direction of the wind.

About noon on 23 December it was again photographed from outer space and as the day went by, reports from the automatic station on Flinders Reef indicated that the centre was passing just south of that location. From these sources of information it was clear that "ALTHEA" was still building up its energy and that its landfall would occur before the next noon.

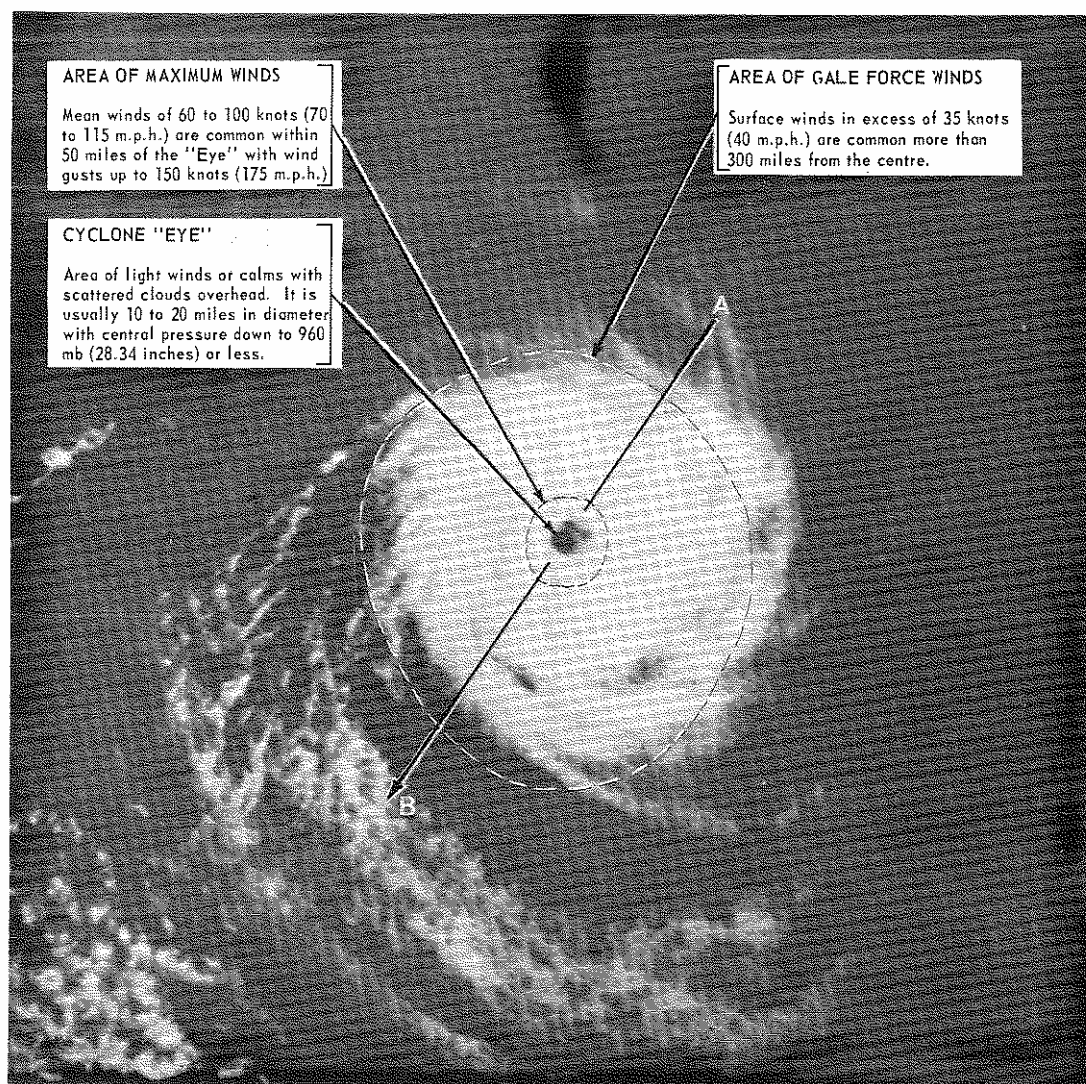


Fig 8 This is a photograph of cyclone TESSIE taken by U.S. meteorological satellite ESSA on 24 February 1972 when it was located in the middle of the Indian Ocean. The cloud mass surrounding the cyclone has a diameter of 370 nautical miles and the "eye" is 25 nautical miles in width. The ocean appears black in sharp contrast to the cloud formations of the tropical cyclone. Winds up to 100 knots or more circulate clockwise around the "eye" of the cyclone. The system as a whole moves with a speed of about five to 15 knots. With a cyclone moving in a southwesterly direction from A to B an observer at B would experience the following weather conditions with the approach and passage of the centre.

For the first 24 hours - southeasterly winds freshening to gales (over 35 knots), an overcast sky with rain squalls increasing in frequency, rising seas.

For the next 5 hours - southeasterly winds of 60 to 100 knots (70 to 115 m.p.h.) continuous heavy rain and extremely rough seas.

For the next 1 to 2 hours - in the "eye" of the cyclone - light variable winds, a confused sea, scattered clouds overhead but a high wall of cloud surrounding the observer.

For the next 5 hours - northwesterly winds of 60 to 100 knots (70 to 115 m.p.h.), continuous heavy rain and extremely rough seas.

For the next 5 hours - northwesterly gales rapidly moderating after the first 2 or 3 hours, rain squalls decreasing in frequency, very rough but moderating seas.

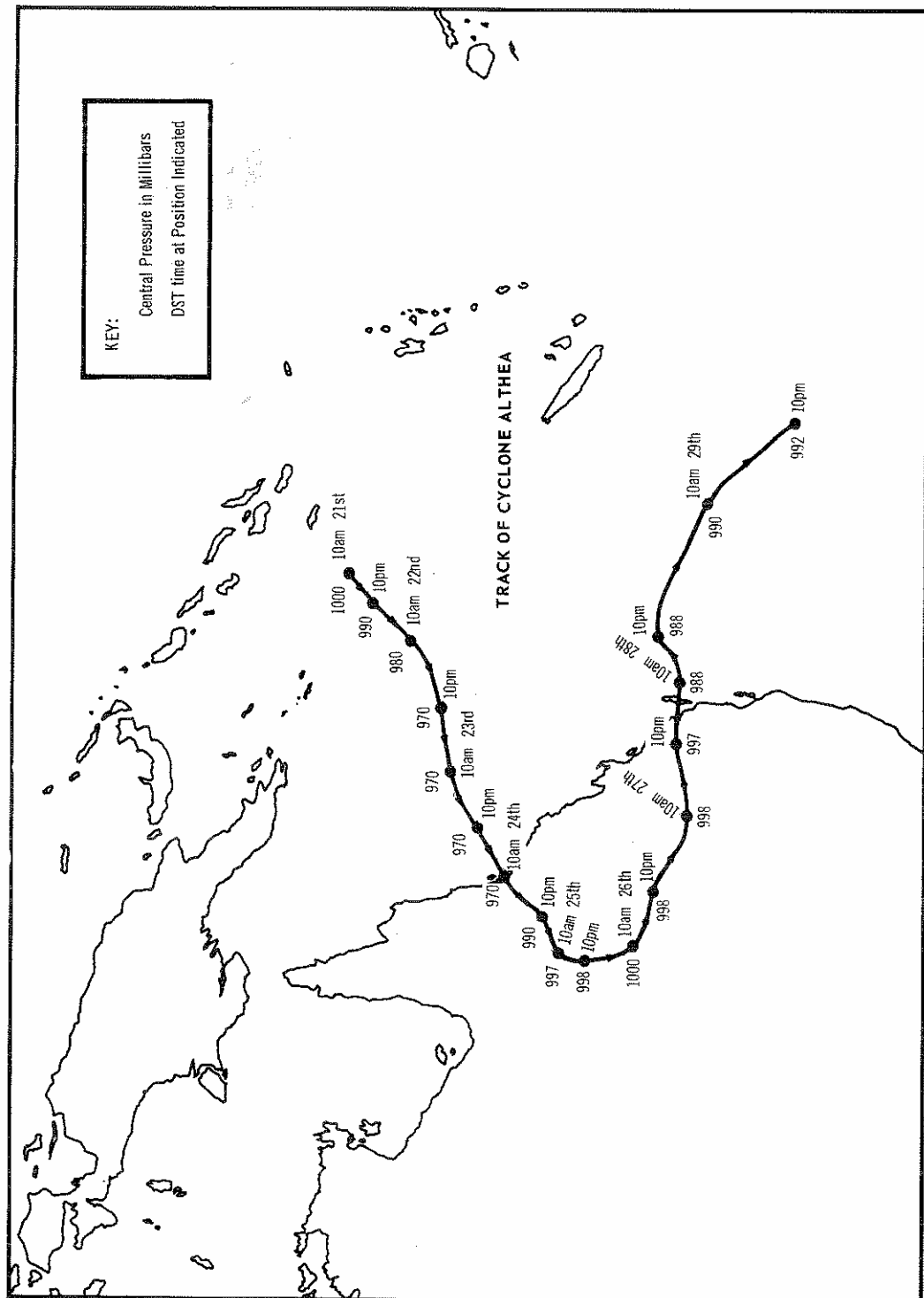
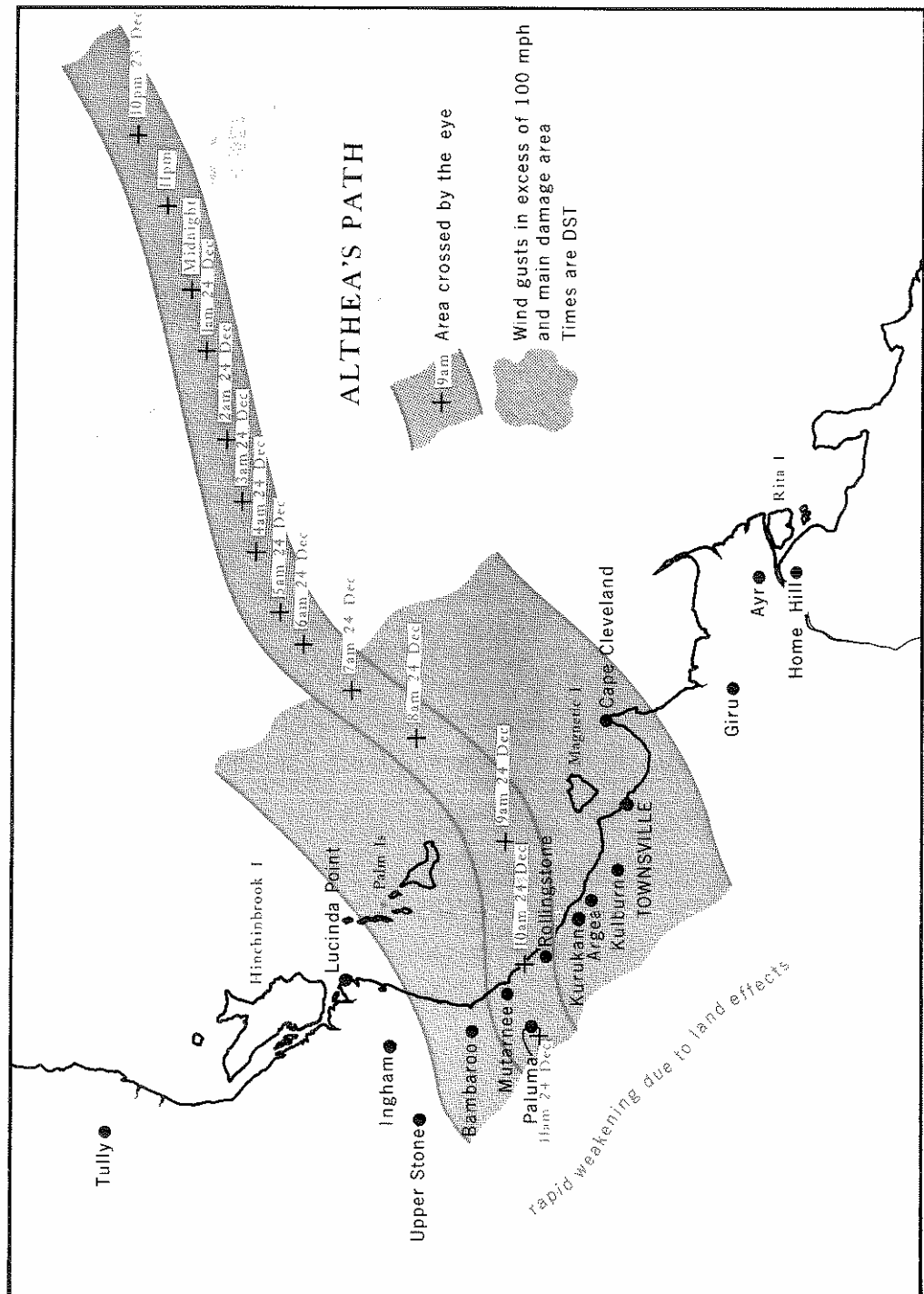


Fig 9 The location of the centre of the cyclone every twelve hours from 10am (DST) on 21 December to 10pm on 29 December. It is important to remember that high winds and rainfall extended about two hundred miles in all directions from the centre and that although any place which was directly in the path of the centre usually had a brief respite as the "eye" passes overhead, it had been buffeted by extremely high winds just ahead of the "eye" and these recommenced from the opposite direction as soon as the "eye" has passed.



BAROGRAPH RECORD MADE AT TOWNSVILLE

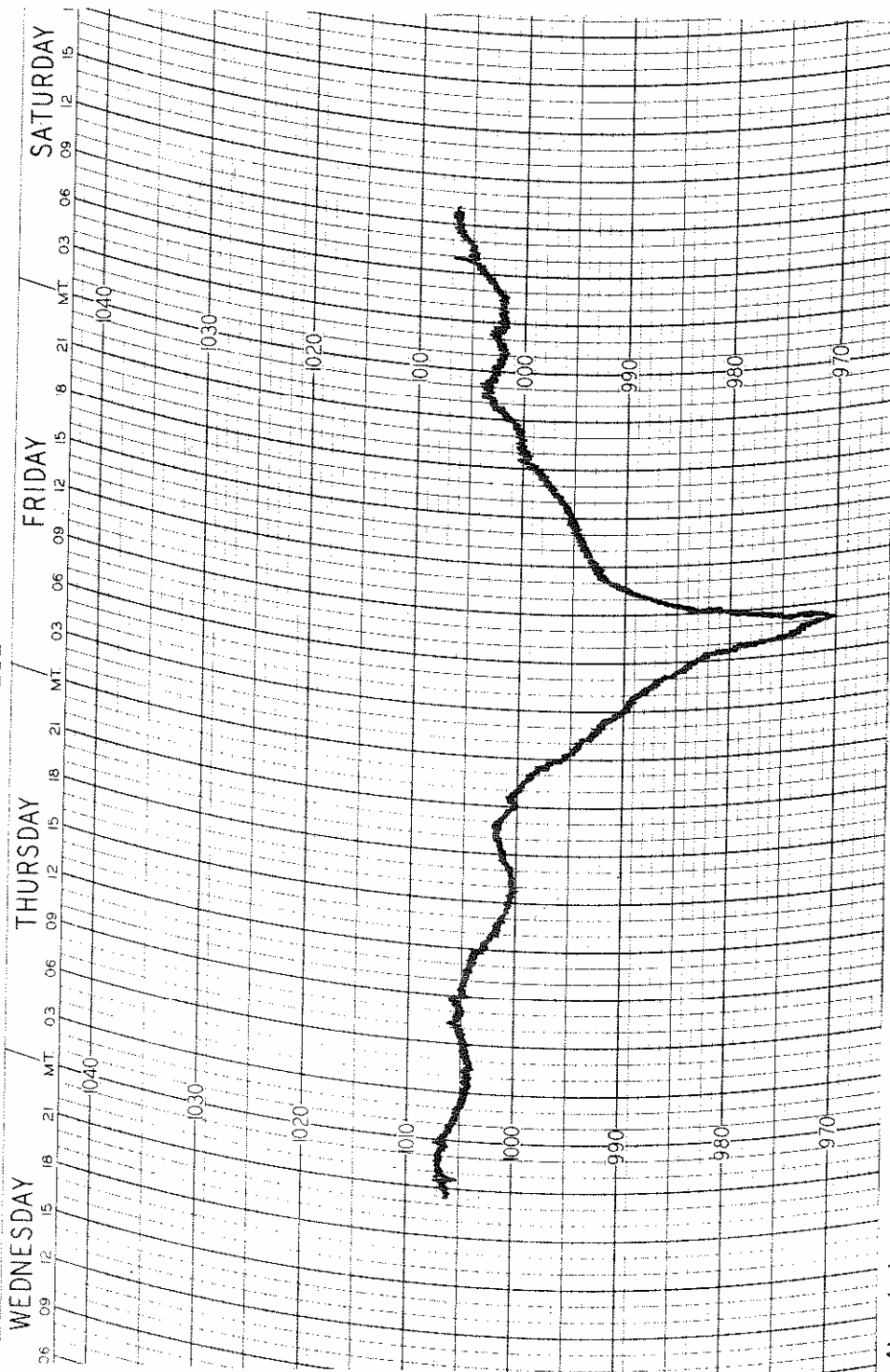


Fig 11b Atmospheric pressure at Townsville from 9pm EST Wednesday 22 December to 10am EST Saturday 25 December 1971 associated with ALTHEA. About twelve hours in advance of the passage of the centre at about 8am Friday 24 December the normal daily rise and fall of pressure was interrupted by a rapid fall and the pressure in Townsville fell to 971.5 mb. After the centre had passed the pressure rose rapidly and after a period of about 12 hours the normal diurnal oscillation was resumed.

At 10 am on 24 December, the relatively calm area of the “eye” crossed the coast some 30 miles north of Townsville so that Palm Island, Magnetic Island and Townsville bore the brunt of the most destructive winds. The unrelenting pressure of the wind drove the sea water before it causing a rise in level of 9 foot in the estuary of the Ross River and flooding the main streets of the city. Gusts reaching 125 mph picked up debris, tore building components loose and drove them with such force that some smashed holes in fibro-cement walls.

Within eight hours of crossing the coast and moving inland in a southwesterly direction, the winds had dropped below gale force but rainfall was exceptionally heavy on 25, 26 and 27 December causing major flooding in all the central and southern interior river systems of Queensland.

“ALTHEA” crossed the coast again towards midnight on 27 December between Double Island Point and Maryborough. Deriving fresh energy from contact with the ocean, the cyclone showed evidence of some regeneration and winds once more rose to gale force between Pinalba and Noosa Heads but its path in a southwesterly direction took it into colder waters and its identity was lost in the Tasman Sea by the end of December. The few days of its contact with the Australian mainland were extremely costly: three people died, the material damage in the Townsville region alone has been conservatively estimated at 25 millions of dollars and the terror, anxiety and sheer inconvenience it produced are beyond assessment.

The reconstructed track of “ALTHEA” from Tuesday 21 December to Wednesday 29 December is shown in Fig 9 and Fig 10 shows the path in greater detail for a twelve hour period during which its landfall occurred.

Texts of the warnings issued by the Bureau of Meteorology’s Tropical Cyclone Warning Centre were:

TROPICAL ADVISORY ISSUED 1.25 PM DST TUESDAY 21 DECEMBER*

“A tropical low showing signs of deepening
has been located by satellite reports about 250 miles
southwest of Honiara stop There is a
possibility of a tropical cyclone developing in
the area stop Advice will be issued of further
developments stop Do not fly red pennant.

* A tropical advisory is an alerting message to meteorological offices and local authorities in areas likely to be affected by a disturbance if it develops into a cyclone. It is not at that stage issued to the general public.

STORM WARNING TO SHIPPING AND AVIATION ISSUED
11 AM DST WEDNESDAY 22 DECEMBER

“Tropical cyclone “ALTHEA” 970 mb centred at 212300 GMT 15.5 south 155.0 east moving south-
West 10 knots stop position good stop wind to
Force 11 near centre stop force 8 within 60 miles
Of centre stop central pressure is expected to
Fall to 965 mb with maximum wind force 12 stop
Expected position 221100 GMT 17.0 south to 25 south
and east to 160 east please sent to WHR Essendon,
weather and radar reports every three hours stop.
Issued 220001 GMT.”

Cyclone warnings for the public commenced on Thursday morning 23 December. The texts were:

FLASH CYCLONE WARNING ISSUED AT 11.30 AM 23 DECEMBER

“At 10 am tropical cyclone ALTHEA central
Pressure below 28.65 inches with gales within
100 miles of centre and maximum gusts near centre
Around 100 mph was estimated to be centred 330
miles east of Cairns and estimated to be moving
west at 10 mph centre expected to move towards
the coast and to be within 200 miles of the far
north coast by 10 pm destructive winds not
expected to affect coastal areas within 20 hours.”

PRIORITY CYCLONE WARNING ISSUED AT 3 PM 23 DECEMBER

“At 1 pm tropical cyclone ALTHEA was
estimated to be centred 260 miles east of Innisfail
and estimated to be moving WSW at 14 mph centre
expected to move towards the coast and be about
130 miles east of Cardwell at midnight with winds
Increasing to gale force between Cairns and
Mackay.”

TOP PRIORITY CYCLONE WARNING ISSUED
AT 5.45 PM 23 DECEMBER

“At 5 pm tropical cyclone ALTHEA was centred 200 miles ENE of Townsville and moving WSW at 14 mph centre expected to be near the coast between Lucinda and Bowen probably in the vicinity of Townsville tomorrow morning with destructive winds with gusts to 100 mph and heavy to flood rains. Gales extending south to Mackay and north to Cairns. Abnormally high tides may occur between Townsville and Mackay tomorrow.”

TOP PRIORITY CYCLONE WARNING ISSUED
AT 7.45 PM 23 DECEMBER

“At 7.30 pm tropical cyclone ALTHEA was Centred 190 miles northeast of Townsville. Radar indicates movement WNW 14 mph past 3 hours.”

TOP PRIORITY CYCLONE WARNING ISSUED
AT 9.15 PM 23 DECEMBER

“At 9 pm tropical cyclone ALTHEA was centred 150 miles northeast of Townsville and moving between west northwest and west at 14 miles per hour. Maintaining intensity with wind gusts to 100 miles per hour near centre.”

TOP PRIORITY CYCLONE WARNING ISSUED
AT 11 PM 23 DECEMBER

“At 10 pm tropical cyclone ALTHEA was centred 140 miles northeast of Townsville and 170 miles east of Tully moving west or west southwest at 10 miles per hour. Centre expected to be close to the coast between Lucinda and Bowen at about 10 am Friday. Destructive winds with gusts to 100 miles per hour near centre with gales extending north to Cairns and south to St Lawrence. Flood rains likely between Lucinda and Mackay and adjacent inland. Abnormally high tides may occur between Townsville and Mackay on Friday.”

TOP PRIORITY CYCLONE WARNING ISSUED
AT 12.15 AM 24 DECEMBER

“At midnight tropical cyclone ALTHEA was Centred 125 miles northeast of Townsville. Movement west southwest 10 miles per hour past 3 hours.”

TOP PRIORITY CYCLONE WARNING ISSUED
AT 1.30 AM 24 DECEMBER

“At 1 am tropical cyclone ALTHEA estimated to be centred 112 miles northeast of Townsville movement west southwest 12 mph past 3 hours.”

TOP PRIORITY CYCLONE WARNING ISSUED
AT 2.35 AM 24 DECEMBER

“At 2 am tropical cyclone ALTHEA centred 110 miles north-north-east of Townsville and 125 miles east of Cardwell stop movement west or west-south-west 10 miles per hour in past 3 hours.”

TOP PRIORITY CYCLONE WARNING ISSUED
AT 3.45 AM 24 DECEMBER

“At 3.30 am tropical cyclone ALTHEA was about centred 95 miles north-northeast of Townsville and 110 miles east of Cardwell moving west or west-south-west at 10 miles per hour maintaining intensity with winds to 100 miles per hour near centre and gales extending to the coast between Cardwell and Mackay. Flood rains coast and adjacent inland Lucinda to Mackay. Next warning to be issued about 5 am.”

TOP PRIORITY CYCLONE WARNING ISSUED
AT 4.30 AM 24 DECEMBER

“At 4 am tropical cyclone ALTHEA was centred about 90 miles north-north-east of Townsville and about 100 miles east of Cardwell moving west or west-south-west at 12 miles per hour closer to coast stop maintaining intensity with gusts to 100 miles per hour near centre and gales extending north to Cairns and south to St. Lawrence stop next warning issued about 5.30am.”

TOP PRIORITY CYCLONE WARNING CENTRE ISSUED
AT 5.40 AM 24 DECEMBER

“At 5.30 am tropical cyclone ALTHEA was centred 85 miles east of Cardwell and 75 miles NNE of Townsville and moving west or west-southwest at 12 mph centre expected to cross the coast between Cardwell and Rollingstone between 10 am and noon, probably near Halifax stop and gales north to Cairns and south to St. Lawrence. Flooding rains between Cardwell and Mackay and up to about 50 miles inland stop Abnormally high tides may occur between Cardwell and Mackay but more particularly in Halifax Bay.

TOP PRIORITY CYCLONE WARNING ISSUED
AT 7.45 AM 24 DECEMBER

“At 7.30 am tropical cyclone ALTHEA was Centred 50 miles north-northeast of Townsville and moving southwest at 12 mph the direction of movement has changed a little and the centre is now expected to cross the coast between Halifax and Cape Cleveland between 11 am and noon stop Destructive wind gusts to 100 mph near centre and gales north to Cairns and south to St. Lawrence stop Flood rains between Halifax and Mackay stop Abnormally high tides may occur Between Cardwell and Mackay.”

TOP PRIORITY CYCLONE WARNING ISSUED
AT 8.30 AM 24 DECEMBER

“At 8.30 am ALTHEA was centred 30 miles almost due north of Townsville and estimated to moving southwest at 12 mph stop Wind gusts near centre in excess of 100 miles per hour.

TOP PRIORITY CYCLONE WARNING ISSUED
AT 9.30 AM 24 DECEMBER

“At 9.20 am ALTHEA was centred 25 miles north of Townsville and moving southwest at 12 mph stop Gusts to 120 miles per hour recorded at Townsville stop Centre expected to reach coast just north of Townsville between 11 am and 12 noon.

TOP PRIORITY CYCLONE WARNING ISSUED
AT 10.40 AM 24 DECEMBER

“Around 10 am cyclone ALTHEA crossed the Coast 30 miles northwest of Townsville moving Inland towards the west southwest stop Centre expected to continue moving inland and should weaken stop Destructive wind gusts to 120 miles per hour near centre expected to moderate slowly stop Gales continuing on coast from centre of cyclone down to Mackay stop Heavy flood rains in neighbourhood of centre and south of centre stop Abnormally high tides may occur on the coast South of the centre.”

FINAL CYCLONE WARNING ISSUED
AT 2.20 PM 24 DECEMBER

“At 2 pm cyclone ALTHEA was about 60 miles West of Townsville and has weakened to such an extent that winds on adjacent coast are expected to drop below gale force soon but heavy rain should continue as the cyclone moves further inland stop No further warnings stop Haul down Pennants.”

PERFORMANCE OF THE TROPICAL CYCLONE WARNING SYSTEM

Detailed investigations into all circumstances concerned with a number of cyclones experienced in previous years have led Bureau officers to consider that the greatest possible attention should be paid to :

- the method of communication of warnings from Tropical Cyclone Warning Centre to media, local authorities and Bureau's offices;
- the method of dissemination of warnings from media, local authorities and Bureau's offices to members of communities threatened by cyclones;
- the need to make members of communities in cyclone prone areas aware of the nature of cyclones, the form of the cyclone warning system, the need for precautionary activities before the cyclone season, protective action which should be taken during a cyclone;

- the need for State Government or local action to produce a disaster plan.

As a result of the Bureau's campaigns in 1970 and 1971 there was a marked improvement in these matters but in a system which is so involved and which is called into action at infrequent intervals, it would be too much to expect that no mechanical and/or human failure would occur. However, the system provides a certain amount of back-up and the Bureau's future plans to include further strengthening of these aspects.

Particular phases of the operation of the Tropical Cyclone Warning System in the case of "ALTHEA" are now discussed in more detail.

Observations for Detecting and Tracking Cyclones

Weather Satellites. Satellite photographs received from the U.S. Meteorological Satellite ESSA 8 by the Bureau's automatic Picture Transmission (APT) readout station in Melbourne were relayed to Brisbane daily. These photographs were vital in detecting and tracking cyclone "ALTHEA" from Tuesday 21 December to Tuesday 28 December. Since then an APT readout station has been installed in the Brisbane centre and is now in operation.

Radar. It was fortunate that new radar equipment had just been installed on Mt Stuart replacing an outmoded radar located on the airport. This installation was not, in fact, in its final form but the temporary arrangement operated effectively and it was the major tracking aid when the cyclone was close to the coast. By midnight on 23 December it located the cyclone's centre 125 miles northeast of Townsville and showed its movement to be westsouthwest at 10 knots. The radar kept the cyclone under continuous surveillance from this time until it weakened inland. Some trouble was experienced in the early stages through voltage variations in mains supply but after the PMG emergency plant took over supply to the unit, there was no further difficulty.

The Bureau tenure of this site is temporary only and it will be necessary to find another location suitable for the purpose of tracking cyclones by 1977. Mt Elliott would be suitable from the aspect of radar coverage.

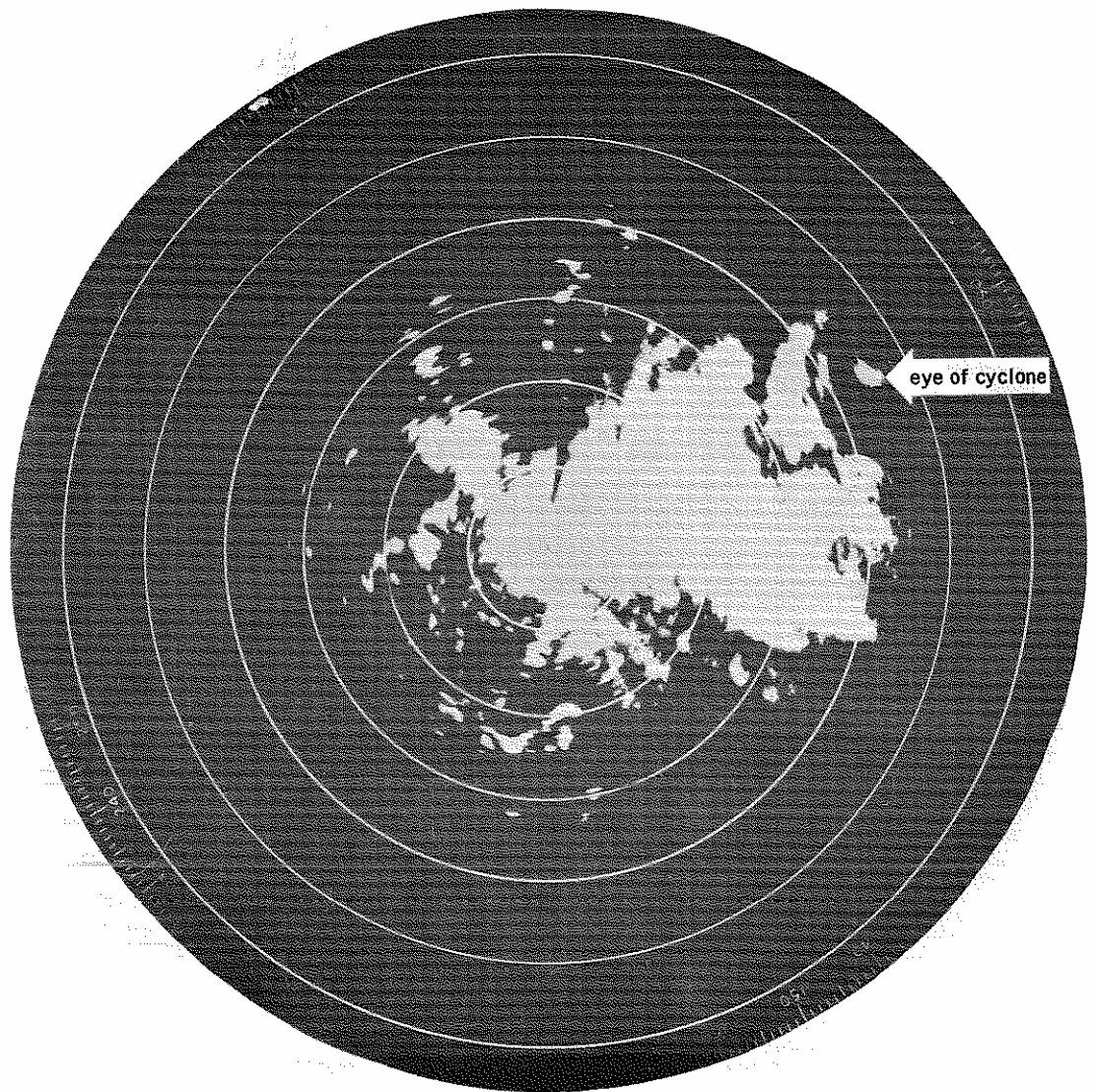


Fig 12a This picture, taken at about 1.30 p.m. (D S T) on 23 December was the first positive radar identification of the cyclone. The areas which show as white patches in the photograph are "echoes" reflected back to the set by rain. A characteristic rainfall pattern reveals the location of the wall of the "eye" to the experienced meteorologist. As the range circles are at intervals of 40 miles, the cyclone centre was then about 185 miles ENE of the Mt. Stuart radar at Townsville.

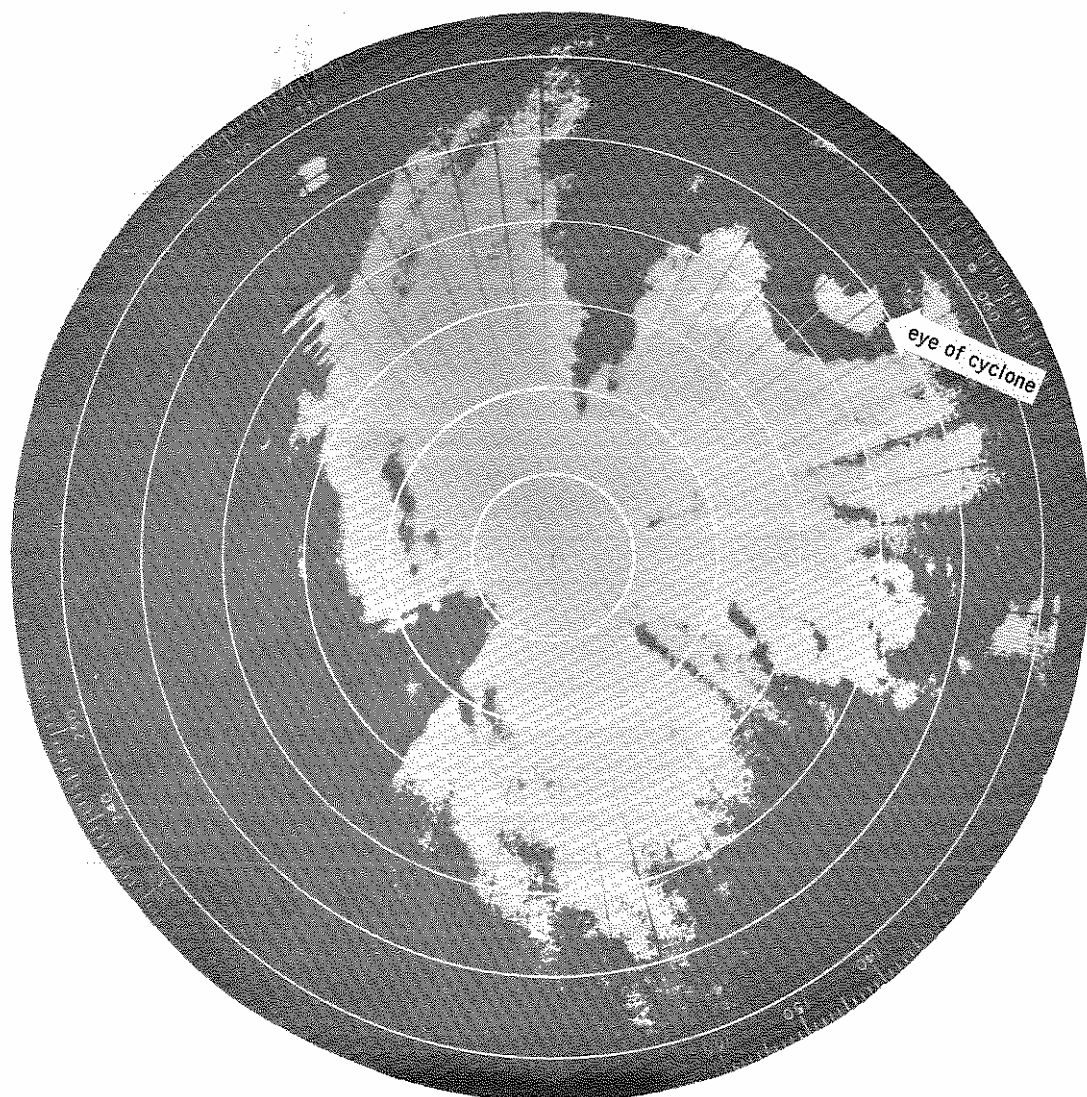


Fig 12b Towards midnight on 23 December, as this photograph of the radar screen on the top of Mount Stuart shows, the "eye" of the storm was about 100 miles NE of Townsville. (The range circles are at intervals of 20 miles).

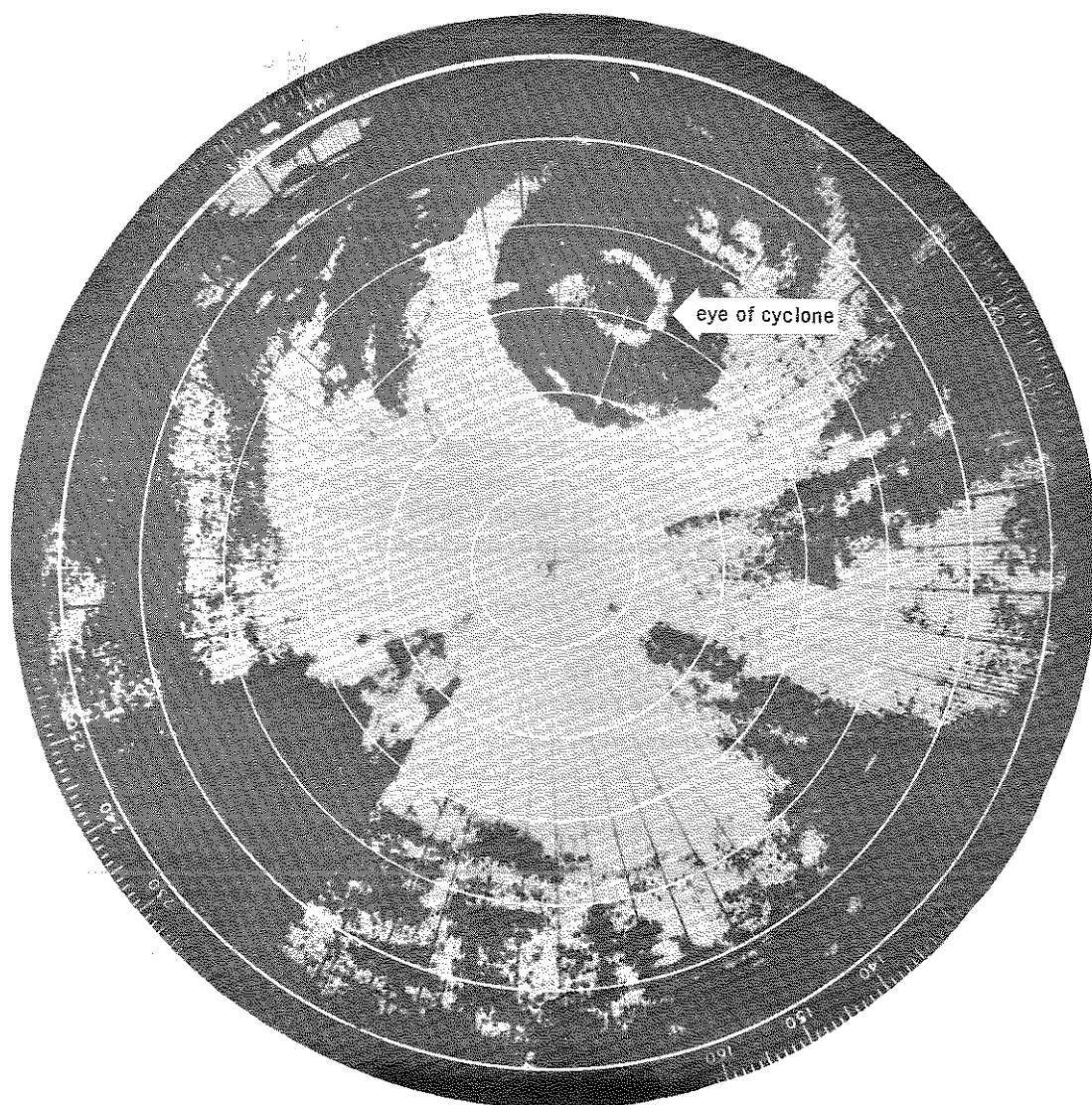


Fig 12c At about 6 a.m. (D S T) on 24 December, when the cyclone was centred about 20 miles east of Great Palm Island and a little more than 30 miles in a direct line NNE of the radar, the structure of its "eye" was clearly revealed on the radar screen. (The range circles are at 10 mile intervals).

Routine and Emergency Synoptic Observations. There
Was no obvious deficiency in the operation of the routine and emergency synoptic network. In fact the volunteer observers at emergency synoptic stations performed admirably, but unfortunately communications were disrupted from most of the observing stations during the passage of the cyclone.

Automatic Weather Stations. Some of the most vital pieces of information used in the formulation of warnings of cyclone "ALTHEA" during Wednesday and Thursday 22/23 December were observations from the automatic weather stations at Lihou, Marion and Flinders Reefs. These confirmed the conclusions which had been reached on satellite information and gave more precise information on wind and pressure well before the cyclone was within range of the radar screen. This was a clear demonstration of the value of the automatic weather stations which the Bureau commenced installing in the Queensland region in 1966. Unfortunately, no further reports were received from these stations after 9 pm on 23 December because the coastal radio station at Townsville which normally monitors them was damaged. Arrangements have now been made to ensure that more than one coastal radio station will have monitoring responsibility and total loss will therefore be unlikely.

Microseisms. Microseismic equipment is used to detect small earth movements produced by waves generated near the cyclone centre. In the case of cyclone "ALTHEA" microseismic observations were not operationally useful. However, post-analysis did show that there was some slight response to the activity of the cyclone.

Atmospheric Direction Finding (Sferics). An interconnected network of radio direction finding stations receives radio waves emitted from lightning flashes associated with large cumulus and cumulo-nimbus clouds which show intense development sometimes associated with cyclone activity. Sferics observations did not assist in the detection of cyclone "ALTHEA".

Communications

Inwards Communications. Communications by which the Tropical Cyclone Warning Centre receives data from satellites, radar stations and other reporting stations worked reasonably well during cyclone "ALTHEA". The Bureau system of back-up communications ensured that essential data reached the Centre during the cyclone when some normal communications facilities were lost.

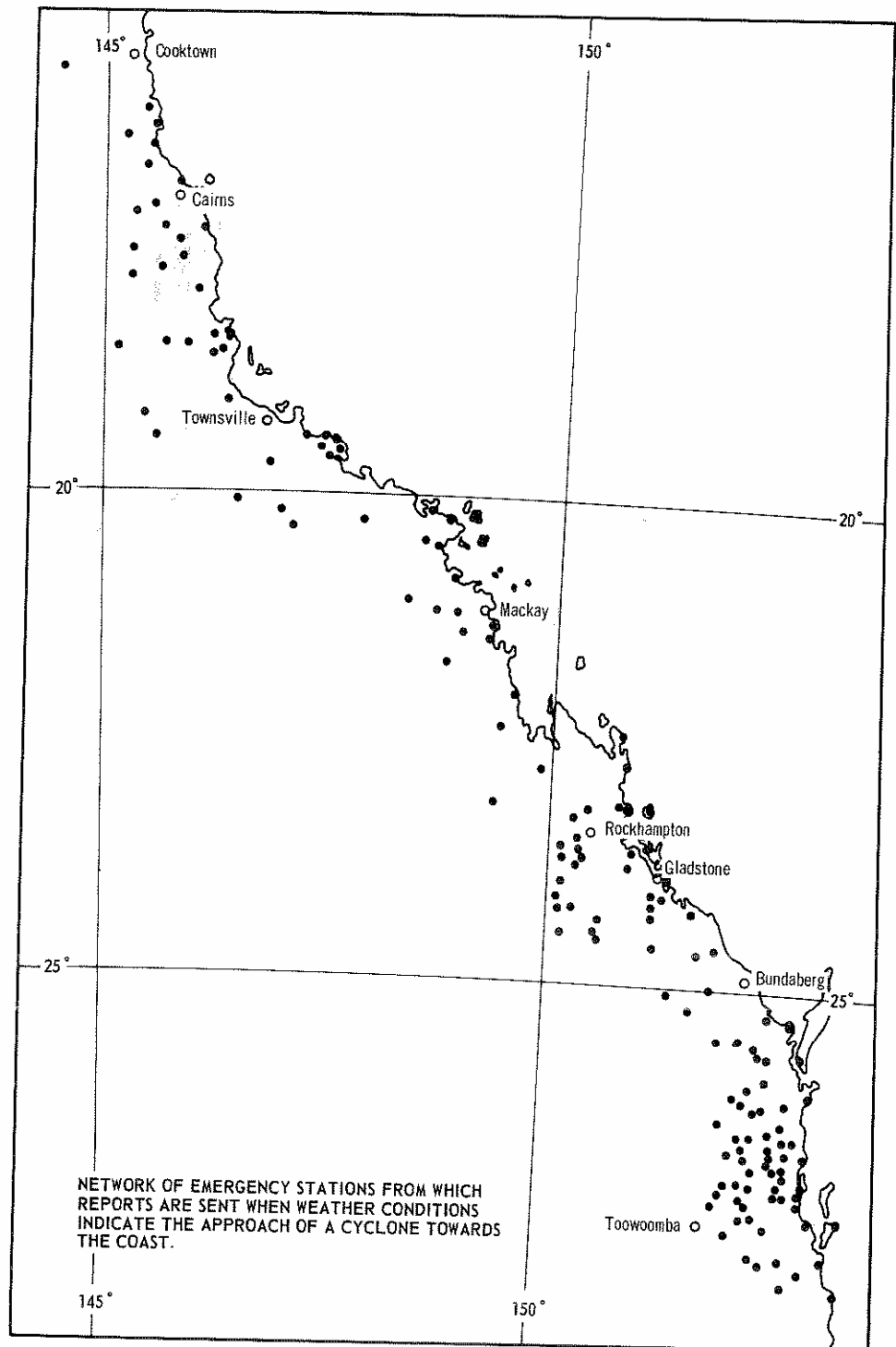


Fig 13 Emergency Reporting Network

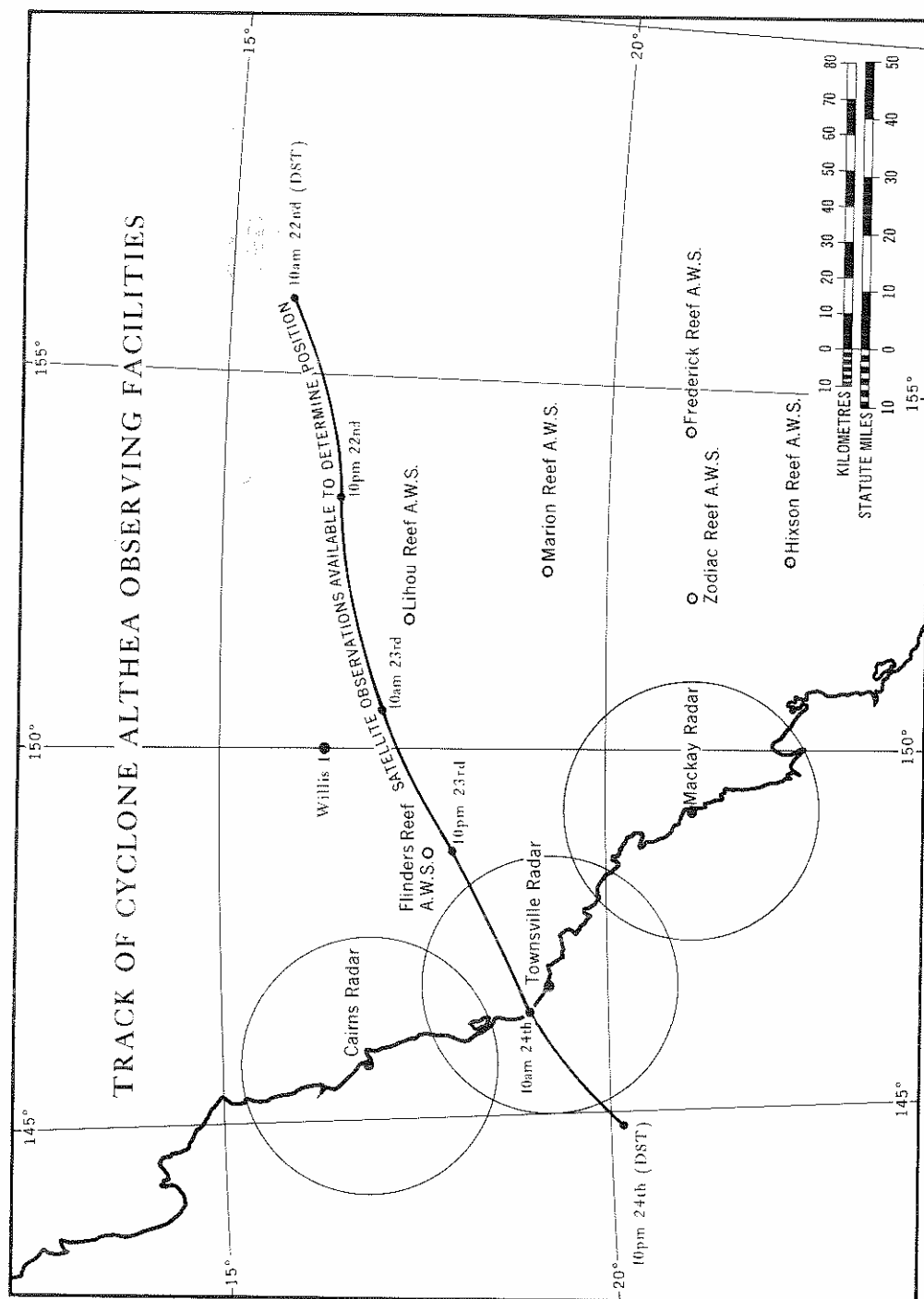
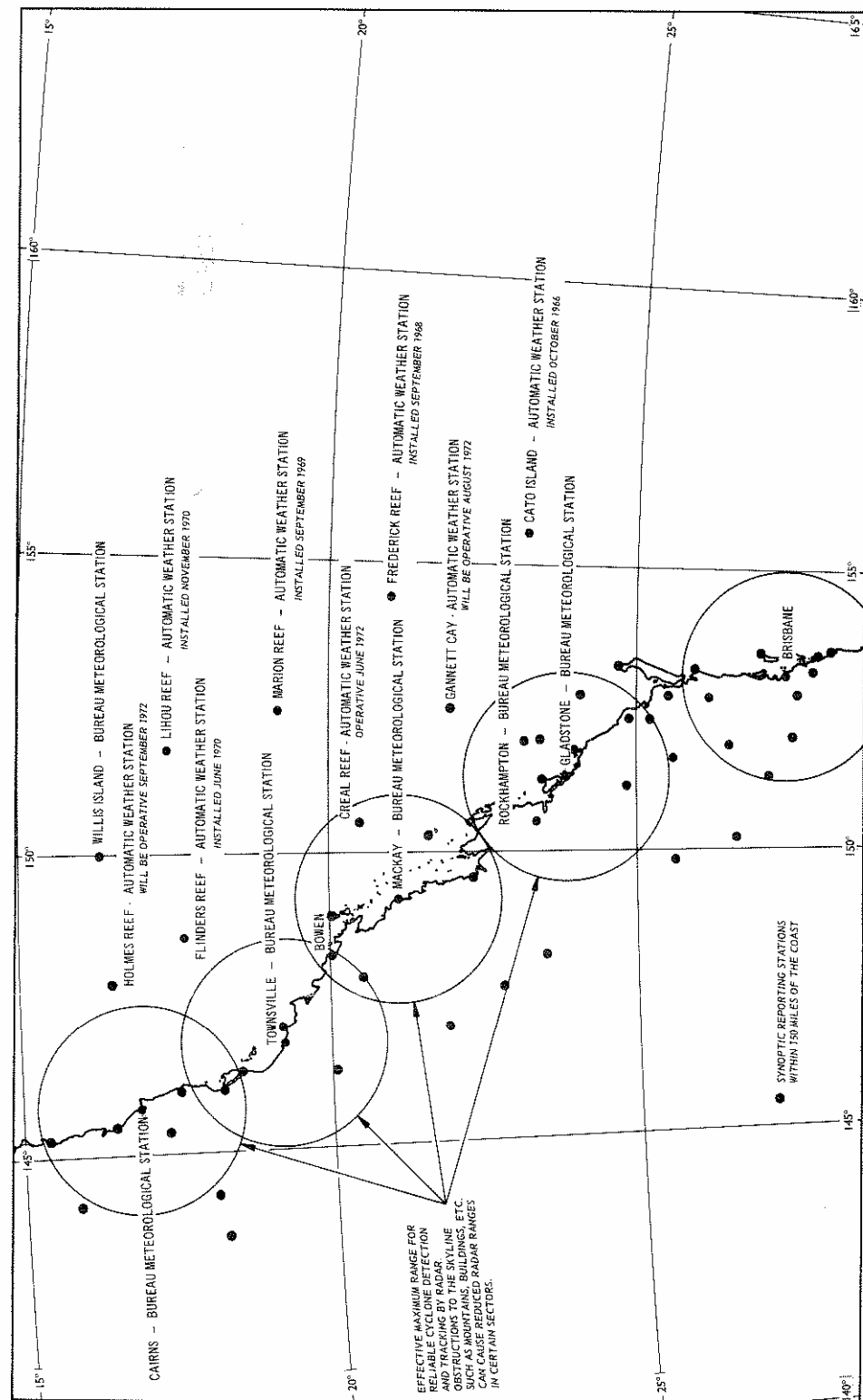


Fig 14 Track of Cyclone ALTHEA as detected by observing facilities. The cyclone was first located through photographs transmitted by the U.S. meteorological satellite ESSA 8. Its position was confirmed at later stages by reports from automatic weather stations and ship reports. From the time it was about 180 miles from Townsville it was under constant surveillance by the radar on Mt Stuart.



For the purpose of urgent discussions between meteorologists at the Warning Centre and operators of radar equipment, a conference telephone circuit on the PMG microwave system was available at the Mt Stuart radar station. This proved to be of great value and refinements to the arrangements will be carried out for all stations before next cyclone season.

As a back-up to the conference telephone, a SSB radio telephone network links all stations. The only point not on this system at the beginning of 1972 was Willis Island but this station will be brought in before the of 1972.

Operation of the Tropical Cyclone Warning Centre.

A close review of the operation of the Brisbane Tropical Cyclone Warning Centre indicates that the centre functioned efficiently but several criticisms of the system were published in the press.

Communication from Tropical Cyclone Warning Centre to Media, Authorities and Bureau's Field Offices. It has always been a difficult matter to ensure that warnings are promptly received by addressees. In this case the communication system appears to have worked reasonably well although about a week afterwards several newspapers reported complaints from unidentified sources that warnings were too few and too late.

For this reason during the period 5-7 January, 1972, the Director of Meteorology Dr. W.J. Gibbs, accompanied by the Regional Director for Queensland, Mr. A.J. Shields, and the Assistant Director Management of the Bureau, Mr. A.T. Bath, visited Townsville to investigate the overall performance of the Bureau's cyclone warning system, and in particular, to enquire into the circumstances of the alleged inadequacies of the warnings.

At a press conference in Townsville on 6 January, 1972, Dr. Gibbs stated that the enquiries had not resulted in pin-pointing any significant deficiencies in the warning system or in the manner of its operation by Bureau staff during the "ALTHEA" situation.

The newspaper criticism of the Bureau's performance during cyclone Althea was concerned with two main points:

- (a) that appreciable delays occurred between the location of the centre and issue of the warnings from the Tropical Cyclone Warning Centre, Brisbane;

- (b) that appreciable delays occurred between issue of warnings from the Centre and the times of local broadcasts.

A full list of the public warnings issued by the Brisbane Warning Centre has been given above. In all, 17 warnings were issued between 11.30 am on Thursday 23 December and the final warning at 2.20 pm on Friday 24 December. During the most critical period, from midnight to 10.00 am on 24 December, when “ALTHEA” crossed the coast, top priority cyclone warnings were based largely on radar pictures from the Bureau’s weather radar at Mt Stuart. The definition of cyclone cloud patterns on the radar screen is somewhat variable and the use of this aid in locating the storm centre calls for skill and experience as well as a consideration of other relevant factors. It is therefore not possible to issue warnings immediately on receipt of the radar picture but a certain period is required for interpretation of the picture and assessment of its significance. Nevertheless, the warnings were issued in most cases within 15 minutes, and in one case much less. The extreme delay of 35 minutes was due to communication disruption between Mt Stuart and Brisbane.

On point (b) there were several possible sources of delay, but the reasons for the delays are difficult to ascertain.

- (a) It has been reported that the Macquarie News broadcast, emanating from 4BH Brisbane and relayed during the night to all commercial stations on the Queensland coast was issuing outdated warnings.

It is understood that the news broadcasts after midnight are from pre-recorded Tapes and may have contained outdated Warnings conflicting with later warnings Received directly by Townsville commercial Stations.

- (b) Another source of delay was a temporary breakdown in PMG communications as occurred with 4 QN.
- (c) The studio of 4TO was wrecked and it was out of communication for a considerable period.

CONCLUSION

Over a number of years, the Bureau has built up a complicated system to help the people of northern Australia arm themselves against cyclone damage. The system depends on a variety of modern equipment and the cooperation of many people but not all the equipment or all the people are controlled by the Bureau. The satellite which usually gives the first alerts, the radio and TV which convey the warnings to the public and the army of people who aid in collecting data and passing on information are as vital to the functioning of the system as the Bureau's own employees and equipment. This vast machinery cannot be put into operation for a "dummy run". It only functions when there is an emergency and its success in the case of cyclone "ALTHEA" and other cyclones on our northwest, northern and northeast coasts is a tribute to the public spirit of many people.

The Bureau has every reason to be proud of the devotion to duty displayed by its own staff both in the Tropical Cyclone Warning Centre in Brisbane and in Townsville. Particularly in the latter centre, under the leadership of Mr. Allan Walker, they remained at their duty posts for long periods in spite of the uncertainty of the safety of their families and personal possessions. Their dedication deserves high commendation.

