

## **Tropical Cyclone Trixie 15/02/1975 – 22/02/1975**

### (i) General

Tropical cyclone “Trixie” was the seventh cyclone of the 1974/75 season to operate in the Northwestern Australian Region. It was the first cyclone of the season to affect the West Australian coast but the various communities were apparently well prepared for it by the publicity given to “Tracy”.

“Trixie” developed on 16<sup>th</sup> February in a low pressure system which had persisted over the Kimberley from early in the month. By 12<sup>th</sup> February atmospheric pressure readings in the system were below 1000 mb and the cyclone formed when the centre of the circulation moved off the Kimberley coast. Subsequently “Trixie” travelled along a path of over 2200 km long which crossed the West Australian coast just east of Onslow. It was estimated that “Trixie” reached a minimum sea level pressure of about 925 mb on 19<sup>th</sup> February. “Trixie” was one of the most intense tropical cyclones recorded on the Australian coast. The wind gust of 246 km/h at Onslow is the highest recorded on an anemograph in Australia.

There was no direct loss of life attributable to “Trixie” and for the pastoral areas of the Kimberley, De Grey, Fortescue, West and Southeast Gascoyne’s and Northeastern Goldfields it was a beneficial cyclone. However there were losses exceeding \$5 million to coastal towns and installations, to station properties due to the winds and the whole State economy from the subsequent flooding which eventually cut the Trans-Australian railway line at Zanthus – some 1700 km from the point of landfall.

### (ii) Development

Tropical cyclone “Trixie” developed from a pre-existing low pressure which had been located over the Kimberley from early in February. The system moved off the land and over King Sound, possibly in response to intensification to the high pressure system in the Bight. After moving across the peninsula south of Cape Leveque and over the open waters of the eastern Indian Ocean deepening progressed. Pressures at several coastal stations fell below 989 mb by 17000. GMT. At that time the cyclone’s central pressure was estimated by applying the Dvorak technique to satellite imagery to be about 970 mb. There were no ship reports to provide confirmatory evidence of such a pressure at this time. To the north of the cyclone a broad westerly monsoonal flow was well established. The cyclonic system was separated from the monsoon by a zone of lighter winds evidenced by several ship reports.

As “Trixie” moved past Port Hedland pressures there fell to a minimum of 981.7 mb when the cyclone was 70 km to the northnorthwest with an estimated central pressure of about 950 mb.

At 180900 GMT the ship “Mikikawa Maur” reported a surface pressure of 964 mb and a southwesterly wind of about 165 km/h.

Before the cyclone's landfall the tug "Wickham" anchored in the Flying Foam Passage (lat. 20.5°S long. 117.8°E) reported a minimum pressure of 957 mb at 181445 GMT. "Trixie's" centre passed to the north of this anchorage.

At 19000 GMT the observer at Mardie reported the pressure to be 957.5 mb the lowest pressure noted at that station. The master of the ketch "Voltaire" moored at Yammadery Creek, 35 km eastnortheast of Onslow recorded in his logbook reading of 953 mb at 190300 GMT.

At Onslow the minimum pressure recorded on the barograph was 995 mb at 190630 GMT. The maximum development of "Trixie" occurred at about the time of landfall when the minimum central pressure was estimated to have been about 925 mb. After moving inland the system began to fill. At 201630 GMT, about 12 hours after landfall, when "Trixie" had travelled some 175 km inland, the pressure at Nyang Station was reported as 970.9 mb. By 22000 GMT the central pressure of the low was about 987 mb and still rising.

In the upper levels of the troposphere a zonal ridge was located to the south of "Trixie". There is some evidence from the upper winds reports from stations along the northwest coast that the cyclonic circulation extended to at least 250 mb on 18<sup>th</sup> and 19<sup>th</sup> February. From 20<sup>th</sup> February the cyclone seemed to be located south of the axis of the upper ridge.

The first anticyclonically curved isobar outside the system on 19<sup>th</sup> February was 1004 mb.

### (iii) Features of the Track (fig. 7.1)

"Trixie" was a separate circulation for seven days during which time it travelled about 2200 km. There were no unusual features. The track described by "Trixie" was normal for the time of the year and the location at which it crossed the coast is an area having a high frequency of coastal crossings.

The low pressure system moved westward off the Kimberley coast about 150 km northwest of Derby. Over the ocean the system rapidly became a tropical cyclone and moved in a generally southwest direction. This took "Trixie" about 120 km to the seaward but after the first 36 hours its track became more convergent with the coastline. At 181230 GMT "Trixie" was 45 km to the northeast of Dampier. By 181900 GMT it was about 55 km west of Dampier and heading at an acute angle to the coast which it crossed at 190400 GMT at Yammadery Creek, a mangrove swamp a few kilometres northeast of the mouth of the Cane River.

The path followed by "Trixie" gradually became more southerly as it moved over the Ashburton hinterland about 100 km inland from the upper west coast. After travelling to about the latitude of Hamelin Pool the remnants of cyclone "Trixie" turned to a more easterly trajectory for about 24 hours before degenerating in the Meekatharra area.

For the whole of "Trixie's" life surface observations and satellite photographs were useful in tracking the system. For a 36 hour period beginning at 17100 GMT the cyclone was also tracked by the WF44 weather watching radar located at Port Hedland airport.

During the period of radar surveillance “Trixie’s speed of movement varied between 12 km/h and 19 km/h. In the other sections of the track its speed varied between 7 km/h and 18 km/h.

Apart from radar reports and the satellite photographs there were a number of reports of typical eye and eye wall conditions. These helped to establish the track shown in Fig. 7.1.

The first of these reports came from the tug “Wickham” sheltering at the top of the Flying Foam Passage about 181500 GMT. The report, received operationally, read “Would like to report that the eye of the cyclone is now passing over the Flying Foam Passage. Barometer is 958 and winds from southeast. Have wind gusts of about 120 km.

A report from the logbook of the ketch “Voltaire” for the 19<sup>th</sup> February established the point at which “Trixie” crossed the coast. “Voltaire” sought shelter at Yammadery Creek, 45 km northeast of Onslow. However, this refuge proved to be directly in “Trixie’s” path. The extract from the log reads “At 0330 (181830 GMT) bar. 985 wind east rain and gusts; at 0600 (182100 GMT) bar. 983 winds to southeast with rain and gusts; at 0800 (182300) GMT. 979 southsoutheast to south winds very strong. Tide levels dropped and all the water was blown out of the creek and the boat lay over on the bottom which made us securely moored at this stage. Marked off barometer reading with chalk on side of casing. At 1200 hrs (190300 GMT) bar. Reading 953 wind southeast very strong. Rain, sea water, mangrove leaves and sand blowing in gusts...” A short lull was reported then “...Trixie suddenly came back harder than ever from the north. The tide raced in like a flash flood...”

During the cyclone’s passage southward reports of the eye were made at a pumping station on the Cane River, at Minderoo Station (190700 to 190900 GMT), Yanrey (191630 to 191730 GMT) and Mia Mia Station (192130 to 200000 GMT).

In addition to these ground locations of the circulation centre several aircraft reports also located the centre. These are listed in Table 7.1. Some of these reports are not consistent with the best-fit position given in Fig 7.1. This discrepancy is probably related to the fact that the aircraft were reporting the circulation in the middle and upper troposphere rather than the earth’s surface.

#### (iv) Rainfall and Flooding

Cumulative isohyets for Western Australia for the period during which cyclone “Trixie” operated are shown in Fig. 7.2. When this distribution is compared with the path followed by “Trixie” it is clear that for the most part the heaviest rainfall occurred within 100 km of the cyclone’s track.

Although Fig. 7.2 shows cumulative isohyets over ten days most of the rain at any location occurred during the period that “Trixie” was affecting the area directly. Thus the Kimberly totals occurred generally near the beginning of the period, those in the Fortescue and De Grey immediately prior to and just after landfall, while those in the central part of the State occurred at the end of the period. The only significant exception to this generalisation were the high totals near the West Kimberly coast where about

half the totals were attributable to the strong westerly monsoonal flow which persisted over that area as “Trixie” moved farther south.

The rainfall maximum east of Carnarvon fell downstream of the major catchment in the Gascoyne River so that the extreme flooding did not occur in that river. Farther south heavy rainfall did occur over the head waters of the Murchison River. Subsequent flooding of this river cut the Northwest Coastal Highway.

An extensive rainfall maximum was centred southeast of Meekatharra. Many lakes in the area were reported to have filled to their highest levels for more than 40 years. Some overflowed and the water moved to the southwest along old watercourses which had carried no more than local run off in flash flood conditions for several decades. Subsequently the Trans-Australia railway was cut at Zanthus where the flow was reported to have maintained at a rate of 200 cusecs for nearly three weeks.

#### (v) Winds and Damage

For the whole of the period that “Trixie” operated off the northwest coast of Western Australia a strong westerly monsoonal flow persisted on the equatorward side of the cyclone. Wind reports from ships in that region frequently exceeded gale force (63 km/h) and reports of storm force winds were not unusual.

Winds in the southern quadrants of cyclone “Trixie” gave a more accurate indication of the intensity of the system. The first reports of winds with easterly components reaching gale force came from Nita Down where from 170000 to 170600 GMT the eastsoutheasterly winds were reported as having reached or exceeded gale force.

The next reports of similar winds were received from Port Hedland. From 172210 to 180520 GMT the mean wind at Port Hedland Airport exceeded 63 km/h. The highest wind gust recorded there was a 124 km/h at 180225 GMT. No significant damage was reported from Port Hedland.

Winds reported from coastal locations farther to the southwest were considerably higher than those experienced at Port Hedland. This was probably the result of two effects, namely the continued deepening of the system and its closer approach to the coast. The highest wind gust recorded at Cape Lambert was 210 km/h at the Cliffs Robe River Iron Associates administration Building. Damage to the buildings at Cape Lambert and Wickham was slight. At Dampier the winds were estimated to have reached a maximum of about 90 km/h for more than eight hours. Damage to structures at Dampier was estimated at \$900,000.

Further westsouthwest at Mardie station a mean wind of 204 km/h was reported with gusts of at least 259 km/h (the limit of the Synchronac anemometer in use) being noted on numerous occasions. The first such gust occurred at 190120 GMT. Thirty of the 78 windmills on the property were severely damaged.

On the Dines recording anemometer located at Onslow the maximum mean wind speed was 176 km/h and a maximum gust of 246 km/h occurred at 191030 GMT. Seven houses in the township were unroofed. The local Meteorological Office and a demountable classroom at the school were demolished.

As “Trixie” moved inland the band of strong winds contracted. However even as late as 210900 GMT winds of 63 km/h were still being reported from near the centre.

(vi) Seas, Swell and Storm Surges

In the westerly monsoonal stream rough seas and a heavy swell were frequently reported. Only after 200000 GMT did the monsoonal stream weaken and the seas diminish. The effects of cyclone “Trixie” on sea conditions were not well documented. Although some damage to wharf installations occurred at Dampier and Cape Lambert, damage caused by sea action was slight when compared with that caused by winds.

There are also no accurate records of any storm surge associated with “Trixie”. A tide recorder installed at the service wharf in Dampier failed during the critical period. Prior to its failing at 181605 GMT the preceding low water was 0.8 m below the predicated level. A visual inspection of the neighbouring foreshores produced no indications of a storm surge.

Both the log books of the ketch “Voltaire” which sheltered in Yammadery Creek and the barge “Ternable” which was moored at Beadon Creek mentioned significant changes in water level. In the report from the “Voltaire” quoted earlier the vessel was stranded in the creek bed when the water was blown out. Later “The tide raced in like a flash flood”.

The master of “Ternable” recorded in his log that 190713 GMT, the time of high water, “...the level of water was below the low water mark, 0.7. m. In one hour the level rose to 3 m or more.” High water at 190713 GMT was predicated to be 1.9 m. At 191100 GMT the master reported that the tide was “...ebbing now with equal velocity as it rushed in on flood.”

The following comment was made by the observer at Mardie Station. “Another interesting feature was the unusually high tide – this was observed through field glasses from our tank stand at noon. I estimate the marsh at the wool shed, one mile away (which I have never known to be covered with sea water only by flood water), was covered with 2 foot of sea water as I could see waves which I reckon were a foot to 18 inches on the marsh. The marsh was still flooded two days later.”

(vii) Satellite Analysis

From at least 13 February the low pressure system located over the Kimberley had associated with it a dense mass of convective cloud about 4° latitude in diameter. This mass was situated immediately to the south of a broad band of cloud generated in the monsoonal westerlies.

In the ESSA 8 photograph of 150114 GMT taken when the surface centre of the system had moved off the land and into King Sound considerable organisation of the cloud system was apparent. The cloud mass especially to the north and west was more extensive than previously. The more broken cloud in the air having an overland trajectory permitted the cloud system centre to be located. The cirrus outflow was not strong and ongoing deepening was anticipated.

On 16 February the system moved into the eastern Indian Ocean north of Broome. The cloud circulation centre appeared to be defined by a tighter curvature of convective cloud bands and was estimated to be T 3 in the Dvorak scheme of classification with ongoing development again expected.

In the ESSA 8 photograph of 170102 GMT a small regular central dense overcast (CDO) was apparent with 1° convective feeder band encircling the CDO one and a half times. The cyclone was classified as having a T number of 4.5. “Tricia” has thus developed rapidly in these first few days.

During the next 48 hours the system became generally larger. The CDO expanded to about 2.5° diameter as the banding became more closely encircled about the system centre. On 19<sup>th</sup> February “Trixie” was estimated to be a T 6.5 cyclone. In none of the photographs was an eye visible.

In the photographs received from ESSA 8 at 200146 GMT, several hours after the cyclone had crossed the coast, the cloud structure had not changed markedly from that of 24 hours previously although the central features were noticeably smaller.

On 21<sup>st</sup> February the cloud associated with the system covered most of the Pilbara and Gascoyne’s with the Southwest Division being mostly cloud free. On 22<sup>nd</sup> February the cloud system centre still related well to the pressure system centre for both were located in the Meekatharra area. The overcast cloud area had extended southeastwards to the Goldfields, while over the Pilbara and Northern Gascoyne’s the cloud had become more broken. The southern half of the State was covered by cloud for the next two days although the cyclone had degenerated into a broad low pressure zone.

A summary of the satellite information is given in Table 7.2.

(viii) Radar Observations

“Trixie” was tracked by the weather radar located at Port Hedland aerodrome from 171005 GMT to 190350 GMT. The relative locations of the eye of the cyclone at selected times during that period are tabulated in Table 7.3. The eye diameter is also included where available.

Table 7.1 Aircraft Reports

| Aircraft       | Date/Time (GMT) | Report   |
|----------------|-----------------|--|
| VH-WRM         | 170744          | Cyclone centre 260° from Derby<br>90 nm (167 km) from coast                              |
| Orion          | 180310          | Radar indicates circular pattern 030°/35 nm (65 km)<br>from Port Hedland                 |
| Orion          | 180335          | Over Dampier 150 nm (178 km) from eye  |
| BA141          | 200900          | Eye appears to be 40/45 nm (74/83 km) northeast of<br>Carnarvon                          |
| CX171          | 201735          | Centre of “Trixie” 60 nm (111 km) southeast of Carnarvon,<br>main weather west of centre |
| Cathay Pacific | 202015          | Cyclone centre 125° magnetic 110 nm (204 km) from<br>Carnarvon                           |

Table 7.2 Data from Satellite Photographs

| Satellite Name | Orbit Number | Date/Time (GMT) | Estimated posn. of centre °S | Estimated posn. of centre °E | Final T No. | Min. Sea Level Pressure (mb) |
|----------------|--------------|-----------------|------------------------------|------------------------------|-------------|------------------------------|
| ESSA 8         | 28276        | 150114          | 16.0                         | 125.3                        | 1.5         |                              |
|                | 28289        | 160206          | 16.5                         | 122.7                        | 3           | 994                          |
|                | 28301        | 170102          | 17.5                         | 121.0                        | 4.5         | 970                          |
|                | 28314        | 180153          | 19.0                         | 118.7                        | 5.5         | 950                          |
|                | 28326        | 190053          | 21.5                         | 115.5                        | 6.5         | 925                          |
|                | 28339        | 190053          | 23.5                         | 114.5                        | -           |                              |
|                | 28351        | 210042          | 26.0                         | 116.2                        | -           |                              |
|                | 28364        | 220133          | 27.0                         | 118.1                        | -           |                              |

Table 7.3 Selected Port Hedland Rarep Reports

| Time (GMT)               | Bearing/Distance (km) Of Eye from Radar | Eye Diameter (km) |
|--------------------------|---|-------------------|
| 171005 (suspect eye)     | 047/274                                 | 65                |
| 1155                     | 047/248                                 | -                 |
| 125                      | 047/241                                 | -                 |
| 1950                     | 035/141                                 | 50                |
| 2100                     | 033/120                                 | 48                |
| 2150                     | 028/106                                 | 44                |
| 2245                     | 017/104                                 | 44                |
| 180000                   | 010/ 91                                 | 41                |
| 0050                     | 006/ 76                                 | 44                |
| 0150                     | 352/ 70                                 | 44                |
| 3005                     | 320/ 70                                 | 41                |
| 0350                     | 318/ 74                                 | 37                |
| 0500                     | 300/ 89                                 | 37                |
| 0600                     | 293/ 95                                 | 48                |
| 0705                     | 289/107                                 | 48                |
| 0830                     | 280/126                                 | 41                |
| 0930                     | 275/139                                 | 48                |
| 1100                     | 274/158                                 | 44                |
| 1230                     | 270/180                                 | 59                |
| 1430                     | 268/193                                 | 74                |
| 1730                     | 264/245                                 | 69                |
| 1940                     | 263/261                                 | 61                |
| 2140                     | 258/278                                 | -                 |
| 2335 (possible centre)   | 255/302                                 |                   |
| 190135 (possible centre) | 253/322                                 |                   |
| 0350 (possible centre)   | 251/339                                 |                   |