



Australian Government
Bureau of Meteorology

Severe Thunderstorms in Perth and Southwest Western Australia, 22 March 2010



Photograph of the approaching storm. Photo Rob Lawry.

**Western Australian Regional Office
Bureau of Meteorology, Perth, WA
26 March 2010**

Summary

Severe thunderstorms occurred on the afternoon and evening of Monday 22 March in the Central West, Lower West, and adjacent parts of the Southwest, Great Southern and Central Wheat Belt districts. In particular, severe storms moved through the Perth metropolitan area between 15:30-18:00 WST causing large hail, heavy rain and severe winds that resulted in damage estimated in the hundreds of millions of dollars.

This storm produced the largest hail known to have occurred in Perth. It was also one of the costliest natural disasters in Perth's history with preliminary damage estimates at over \$100 million. The storm was the most significant weather event in terms of power outages (over 150,000 properties without power at the peak) and the number of requests for assistance from FESA-SES (over 3000) since the May 1994 wind storm.

Meteorological Description

The storms resulted as a combination of low level convergence associated with a surface trough; surface temperatures in the low to mid 30s; surface dewpoints 17-19C; and strong instability assisted by a deep mid-level low off the west coast. This low caused the steering wind for the storms to be northerly [which is unusual], ensuring that storms forming near the coast well north of Perth remained close to the coast and affected the metropolitan area.

Storms developed near Badgingarra, about 180 km north of Perth just after midday (Fig. 1a) and tracked to the south near the coast. The leading storm gathered intensity and reached the far northern suburbs at about 15:00 WST, and the central business district and western suburbs by 16:00 WST (Fig 1b-c). Ocean Reef Automatic Weather Station recorded wind gusts to 120 km/h, while large hail, measured to 6 cm, dented cars and broke windscreens, windows, and light roofing material.

A second line of storms swept across Perth an hour later causing a period of intense rainfall across much of the metropolitan area (Fig 1d). Hail accumulation in gutters exacerbated water inundation of properties.

By 18:30 WST a line of storms had developed from the initial severe storm extending along its eastern flank at the expense of the second line of storms that had weakened in its wake (Fig 1e). These storms tracked to the south and south southeast during the evening and accounted for the intense precipitation measured south and southeast of Perth.

Rainfall

The daily total for Mt Lawley was 40.2 mm which was the fifth highest daily rainfall for March on record for the official Perth site. Of this rain 23.0 mm fell in 10 minutes and 38.4 mm fell in one hour. Wanneroo (DAFWA site) in the northern suburbs recorded 62.8 mm in two hours, including 27.8 mm in just 10 minutes, and these values exceed the 1:100 year Average Recurrence Interval (ARI). Figure 3 shows the Intensity Frequency Duration curve for Jarrahdale (southeast of Perth) where a total of 57.2 mm of rain fell. Of this total 54.2 mm fell in one hour and 44.2 mm fell in 30 minutes. This rainfall exceeds the 1:100 year ARI for periods of 15 minutes to one hour. The highest daily total for the event was 80.8 mm recorded at Moodiarrup (southeast of Collie) while Pingelly in the Great Southern reported a record March daily total of 78.6 mm and nearby Narrogin registered 69.5 mm.

This was the first significant rainfall for many locations in the southwest after a very long dry summer.

Hail

The largest recorded hail occurred in Perth's western and northern suburbs between 15:30 and 16:15 WST. Hail to 6 cm diameter was measured in Wembley (see photo in Fig. 4) while 5-6 cm hail is likely in the adjacent suburbs of Crawley, Nedlands, Shenton Park, Subiaco and Floreat. Reports of golf ball-sized (3-5 cm) were received in areas around Osborne Park, Nollamara, Craigie, Kallaroo, Duncraig and Carine. It is likely many other suburbs also received hail of at least 3 cm diameter. South of the river large hail was reported from South Perth and Como but it appears the hail was mainly confined to riverside suburbs.

Wind

Cunderdin in the Central Wheat Belt recorded the highest wind gust of 128 km/h during storms at 19:14 WST. Other severe wind gusts were recorded at:
Ocean Reef, 120 km/h at 15:48 WST.
Badgingarra, 117 km/h at 14:58 WST.
Jandakot, 96 km/h at 16:30 WST.

Impact

A preliminary estimate of the damage has been put at \$100-120 million. FESA-SES responded to more than 3000 calls for assistance, about seventy per cent occurring north of the river. At its peak more than 150,000 Perth properties were without power. About 15 schools were closed the following day owing to damage, while many hospitals were also damaged.

The worst damage occurred in areas having large hail in a strip extending from the northern coastal suburbs (including Currumbine and Wanneroo) to Sorrento/Duncraig/Greenwood to Nollamara/Tuart Hill/Osborne Park to Floreat/Subiaco/Shenton Park/Crawley and to South Perth. For many of those suburbs, particularly from Osborne Park to Crawley hail from 4-6 cm was large enough to badly damage cars including breaking car windscreens and house windows. The hail also blocked gutters and drains exacerbating the flooding impacts. Many properties were inundated with water including the University of Western Australia's library. There were isolated reports of roof damage from severe winds including Canning Vale in the southeastern suburbs.

A landslip at Kings Park caused the evacuation of several apartment towers as mud inundated lower levels and threatened their stability.

Warning/Forecast Summary

The 'chance of a thunderstorm' was first mentioned on the Perth forecast on the previous Thursday [18 March] morning.

The first Severe Thunderstorm Warning was issued at 9:45am Monday 22 March. This was issued prior to the formation of the storms based on a very high confidence of severe storms occurring. The warning was re-issued to make particular mention of the direct threat to Perth at 2:30 pm and then re-issued at half-hourly intervals into the evening and was finally cancelled at midnight.

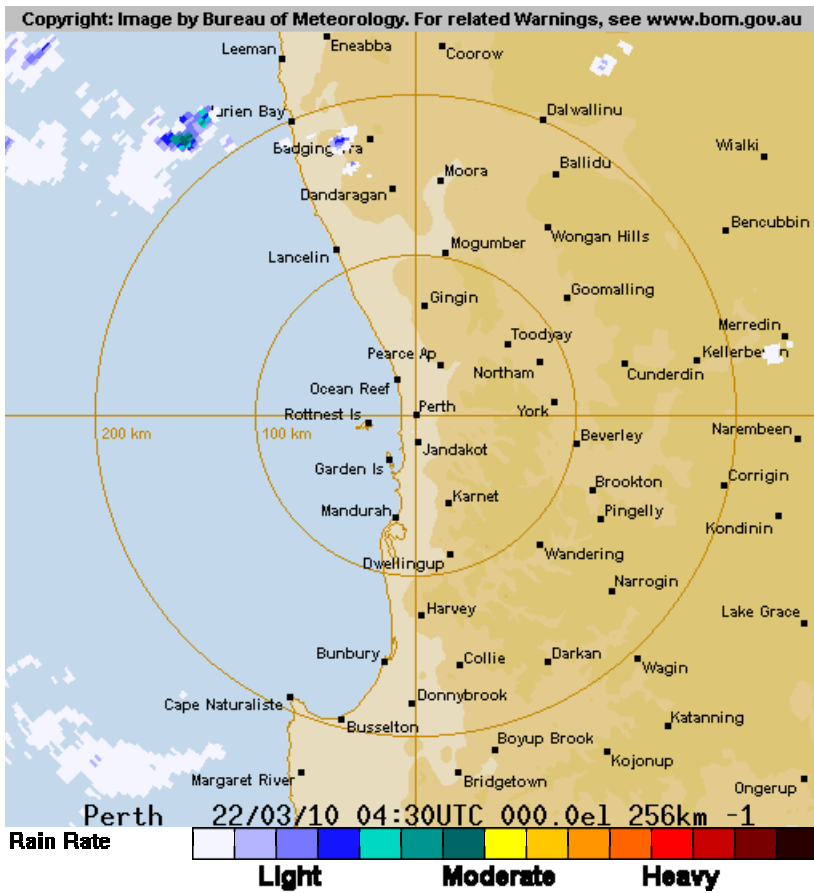


Figure 1a. Perth radar image at 12:30 WST (04:30 UTC) 22 March showing a thunderstorm developing near Badgingarra, about 180 km north of Perth (256 km scale).

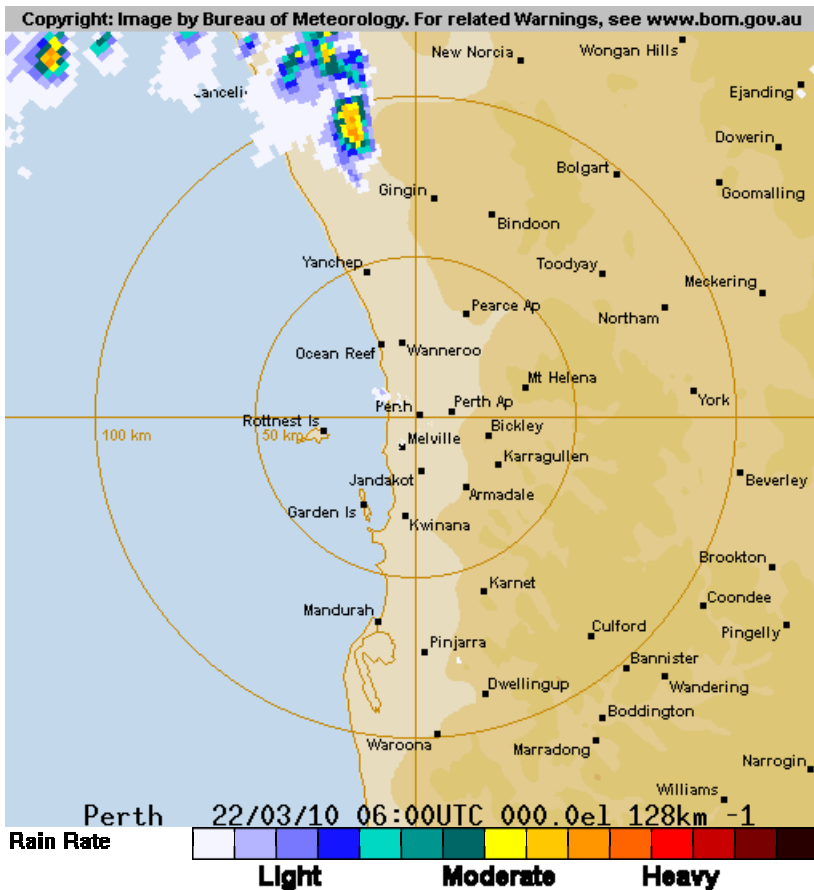


Figure 1b. Perth radar image at 14:00 WST (06:00 UTC) 22 March showing approaching thunderstorms 90 km to the north of the city (128 km scale).

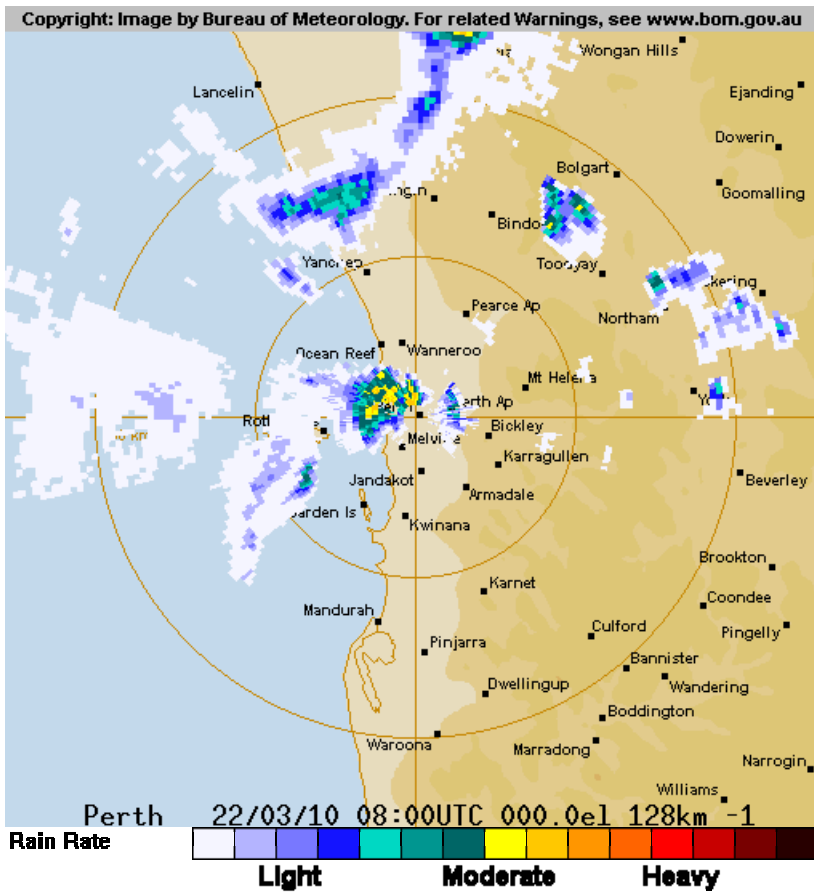


Figure 1c. Perth radar image at 16:00 WST (08:00 UTC) 22 March showing thunderstorms in the western suburbs with other storms approaching further to the north.

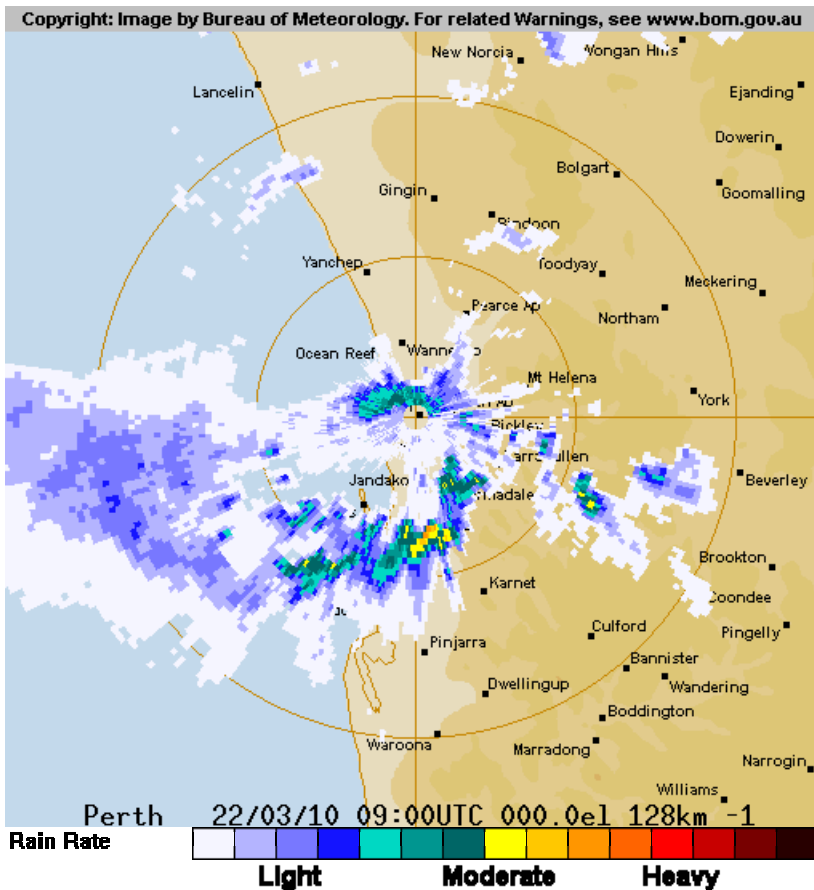


Figure 1d. Perth radar image at 17:00 WST (09:00 UTC) 22 March showing severe thunderstorms south of the city and over the city and western suburbs.

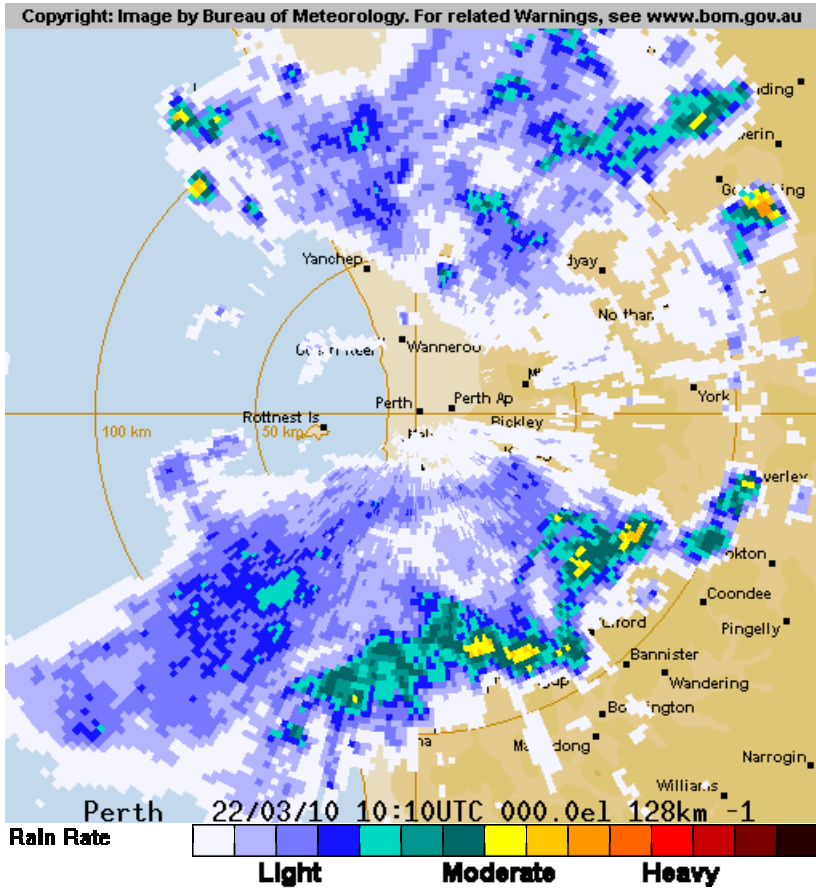


Figure 1 e. Perth radar image at 18:10 WST (10:10 UTC) 22 March showing severe thunderstorms south of the city and an area of showers and storms to the north.

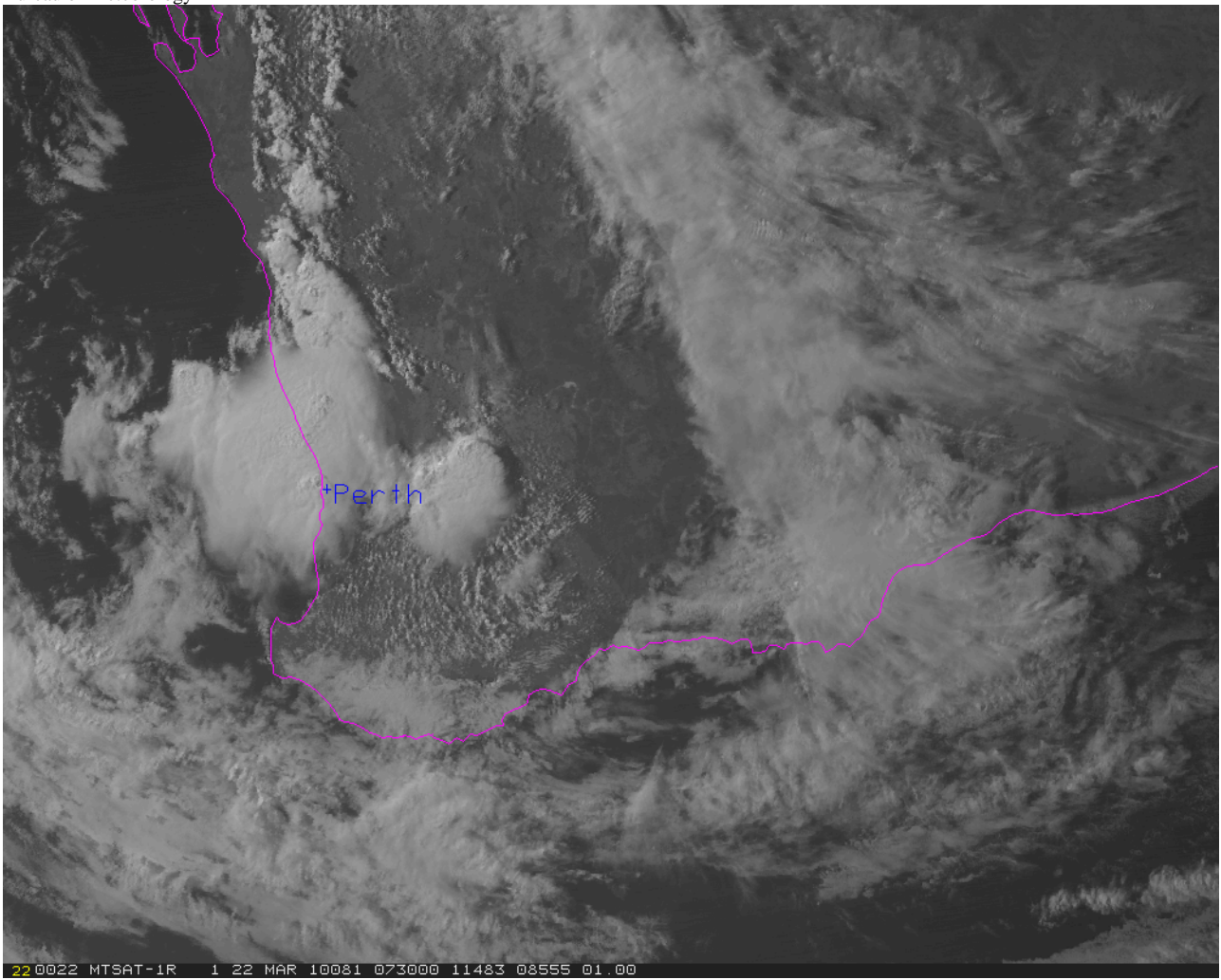


Figure 2. Visible Satellite image at 15:30 WST showing storms near Perth. MTSAT image courtesy of Japanese Meteorological Agency.

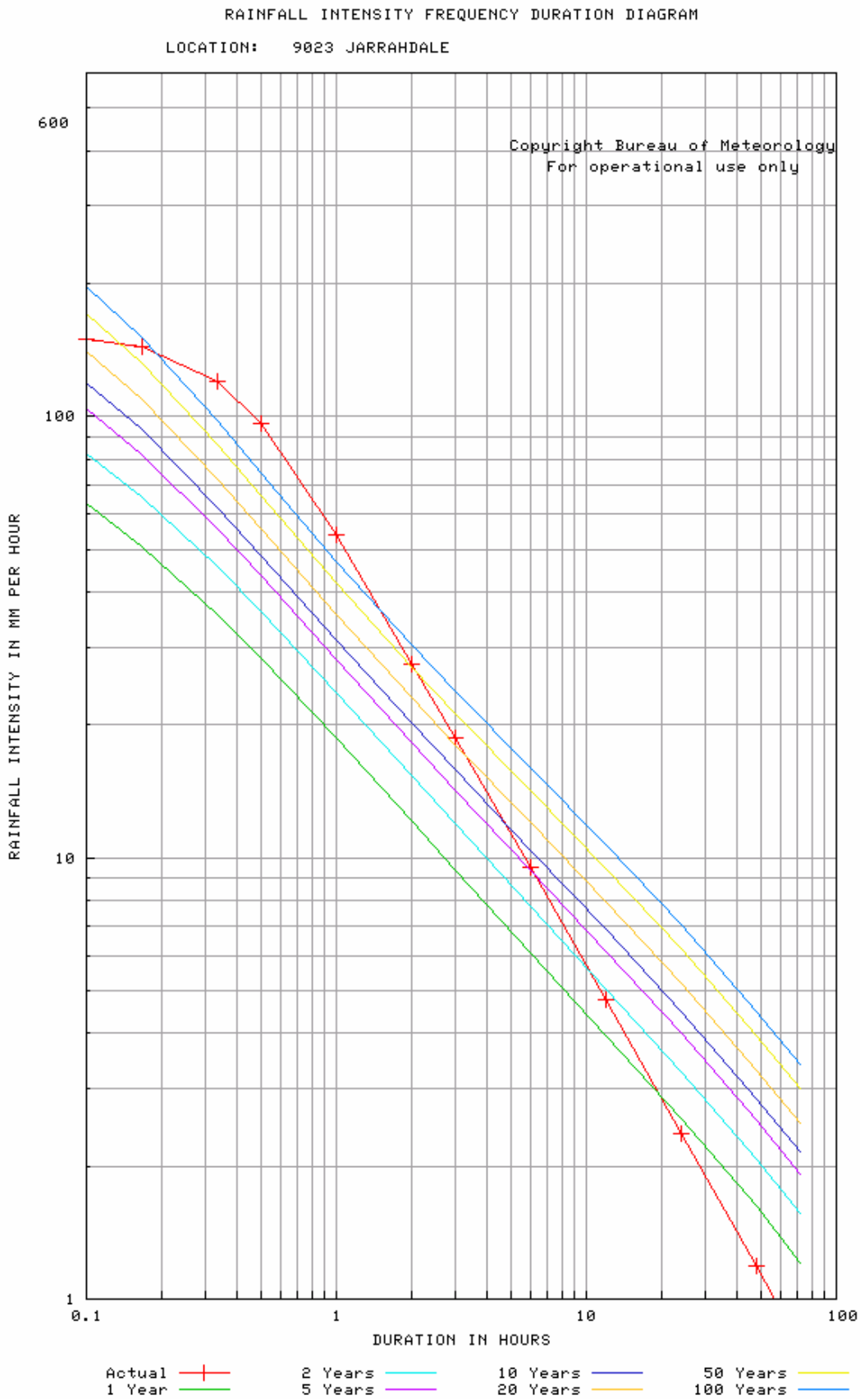


Figure 3. Intensity Frequency Duration curve for Jarrahdale. Rainfall for 22 March 2010 (in red) exceeded 100 year Average Recurrence Interval for periods from 15 minutes to one hour. For explanation see: <http://www.bom.gov.au/water/designRainfalls/ifd/>



Figure 4. Hail was measured to 6cm in Wembley. Photo courtesy of Adam Conroy.



Figure 5. The approaching storm with shelf cloud visible ahead of the heavy rain. Photo courtesy of Rob Lawry.