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Western Downs Regional Council Flood Review and Management Study

Stage 1 Report – Flood Review February 2013

WESTERN DOWNS REGIONAL COUNCIL

Western Downs Regional Council - Flood Review

Prepared For:	Western Downs Regional Council
Prepared By:	BMT WBM Pty Ltd (Member of the BMT group of companies)

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BMT WBM Pty Ltd

BMT WBM Pty Ltd
Level 8, 200 Creek Street
Brisbane 4000
Queensland Australia
PO Box 203 Spring Hill 4004

Tel: +61 7 3831 6744
Fax: + 61 7 3832 3627

ABN 54 010 830 421

www.bmtwbm.com.au

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Project Manager :	Barry Rodgers
Client :	Western Downs Regional Council
Client Contact:	Liz Drumm
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GLOSSARY

ARI	Average Recurrence Interval is the measure of the rarity of the event; it is the estimate of the interval of time between events. For a 100 year ARI event, there is a 1% chance that this event can occur in any given year. However it should be noted that planning for a 1 in 100 ARI event does not guarantee immunity for the next 100 years.
AEP	The probability that a flood of a given magnitude will be exceeded in any one year.
Backwater effect	The effect which an obstruction has in raising the surface water upstream of it.
BoM	The Bureau of Meteorology is the Australian Government's Executive Agency tasked with providing national weather and climate information. BoM provides weather forecasts, warnings, monitoring and advice.
Catchment	The catchment at a particular point is the area of land that drains to that point.
Design flood	A hypothetical flood used for planning and floodplain management investigations. It is defined by the probability of its occurrence and represents a flood which has a particular chance of happening in any year.
Hydrograph	A graph showing how a river or creek's discharge changes with time.
LDMG	Local Disaster Management Group
LGAQ	Local Government Association of Queensland
mAHD	Elevation in metres to Australian Height Datum (based on mean sea level for 1966-1968).
Probable Maximum Flood (PMF)	An extreme flood deemed to be the maximum flood likely to occur.
Runoff	The amount of rainfall from a catchment that actually ends up as flowing water in the river or creek.
Stream Gauge	A site along a stream where measurements of water surface elevation and or volumetric discharge (flow) are made.
Velocity	The speed at which the flood waters are moving. Typically, modelled velocities in a river or creek are quoted as the depth and width averaged velocity, i.e. the average velocity across the whole river or creek section.

1 INTRODUCTION

BMT WBM Pty Ltd was commissioned by Western Downs Regional Council (Council) to conduct a Flood Review and Management Study following the flooding which took place across the area in December 2010 and January 2011. The overall study consists of three principal stages:

- Stage 1: Review of available information and familiarisation of existing flood behaviour;
- Stage 2: Identification and assessment of flood management measures; and
- Stage 3: Production of the flood management plan.

This report presents the output of Stage 1. It has the following aims:

- To summarise the summer 2010/2011 floods which affected the region;
- To collate and standardise the information collected from various sources on the summer 2010/2011 floods and any flood modelling that has been undertaken within Council's area; and
- To identify which localities should be considered in more detail in the Floodplain Management Study and to identify whether any further information will be required to support this such as LiDAR or property data.

Background

Western Downs Regional Council's principal town of Dalby and regional towns of Chinchilla, Miles, Warra, Jandowae, Tara and Condamine experienced major flooding events during the period of December 2010 to January 2011. In addition, the majority of the region's rural localities experienced flooding and isolation to varying degrees.

As part of the work commissioned by the Local Government Association of Queensland (LGAQ) on behalf of Western Downs Regional Council, BMT WBM prepared a report on the flooding within Councils area in December 2010 and January 2011. The focus of this report was on the flooding that occurred in Dalby, Chinchilla and Condamine. The report provided details on what occurred in the floods, previous flood studies and flood warning and emergency management effectiveness. The report was specifically prepared to assist the Queensland Floods Commission of Inquiry. This report builds on that earlier work to consider the other affected localities within the Western Downs region.

Council collected a large volume of information following the summer 2010 / 2011 flooding. The information has been summarised and used for this report. In addition, discussions have been held with key Council staff and visits were undertaken to a number of affected areas to gain an appreciation of the issues.

Flood and stormwater analyses have been undertaken by Water Technologies which present an understanding of existing flood risk within Council's area for Chinchilla, Miles, Wandoan, Jandowae and Tara, identifying areas at risk of flood inundation up to the 1% Annual Exceedance Probability (AEP) design event (equivalent to the 100 year Average Recurrance Interval). These have been used to inform the flood behaviour described in this report along with the existing Flood Study for Dalby (SKM, 2007).

2 CATCHMENT CHARACTERISTICS

This section presents a summary of the main catchment and creek characteristics for each town under consideration in the study. The list of localities is not definitive and may be expanded following receipt of further information. A brief summation of historical flooding is also presented.

2.1 Overview

Western Downs Regional Council covers an area of around 38,000km^2 and has a population of 30,000. The principal river system with Council's area is the Condamine system. The headwaters of the Condamine River are located approximately 200km south east of Council's area and so by the time the river enters Council's area, passing under the Moonie Highway near Nandi it is already of a significant size.

Approximately 60% of the area drains into the Condamine River via numerous tributaries. Many key urban centres are located on these tributaries and are discussed in greater detail below. The only town located adjacent to the Condamine is the town sharing the same name as the river. After passing through Condamine Town, the river flows for another 75km before entering the neighbouring Roma Regional Council area where it becomes the Balonne River and eventually part of the Darling River.

Watercourses located to the north of the Condamine catchment within Council's area are situated on the opposite side of the Great Dividing Range. These watercourses form the headwaters of the Fitzroy and Burnet River systems which discharge into the Pacific Ocean at Rockhampton and Bundaberg respectively. The north western headwater catchment is that of Juandah Creek and drains approximately 15% of Council's area. The north eastern catchment is that of the Auburn River which drains approximately 8% of Council's area.

The remainder of the area to the south is located within the catchments of the Moonie and Weir Rivers which account for drainage from 15% and 2% of Council's area respectively. These rivers eventually combine to form the Barwon which then becomes part of the Darling River.

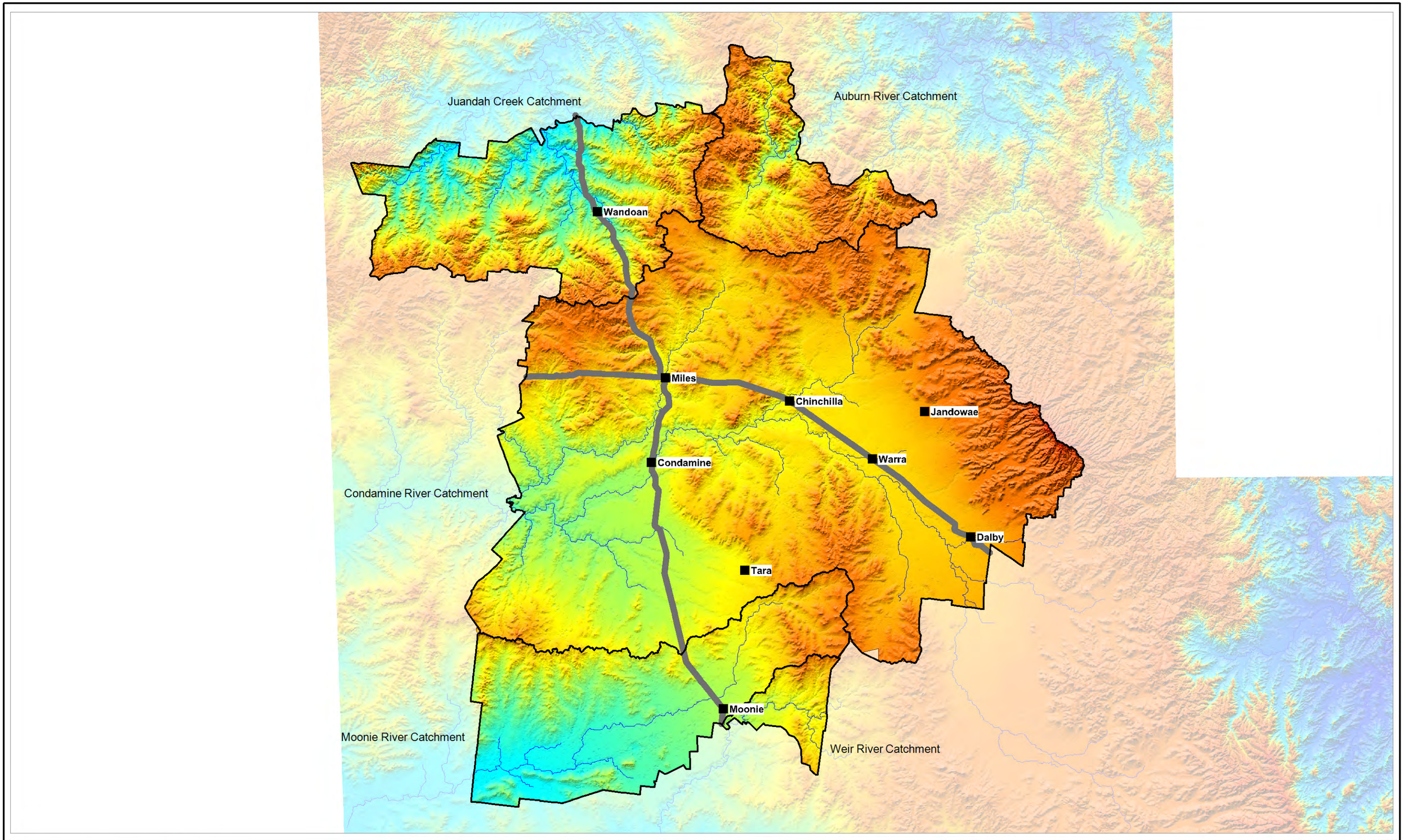
Figure 2-1 shows the breakup of Council area into its major drainage components. Key towns and major roads are shown to assist with viewing. Figure 2-2 shows the Condamine catchment and it can be seen from Figure 2-2 that the majority of towns under consideration in this study are located within this regional catchment.

Also shown in Figure 2-2 are selected river gauges along the length of the Condamine.

Table 2-1 presents a summary of key statistics in relation to the upstream drainage catchment to each town. The statistics are approximate and are provided to facilitate a general comparison between the catchments.

Table 2-1 Catchment Summary Statistics by Town

Town	Approx Elevation	River/Creek	Creek Length	Upstream Area	Fall in Elevation
Dalby	343 mAHD	Myall Creek	60 km	1,375 km^2	646 m
Chinchilla	305 mAHD	Charley's Creek	90 km	3,800 km^2	285 m
Miles	307 mAHD	Dogwood Creek	80 km	2,600 km^2	113 m
Jandowae	358 mAHD	Jandowae Creek	45 km	220 km^2	292 m
Wandoan	265 mAHD	Juandah Creek	50 km	600 km^2	195 m
Tara	312 mAHD	Undulla Creek	12 km	140 km^2	52 m
Warra	317 mAHD	Cooranga Creek	65 km	950 km^2	443 m
Condamine	282 mAHD	Condamine River	420 km	24,800 km^2	718 m



LEGEND

Western Downs Regional Concil

Title:
WDRC Regional Catchments

Figure: **2-1**

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Approx. Scale

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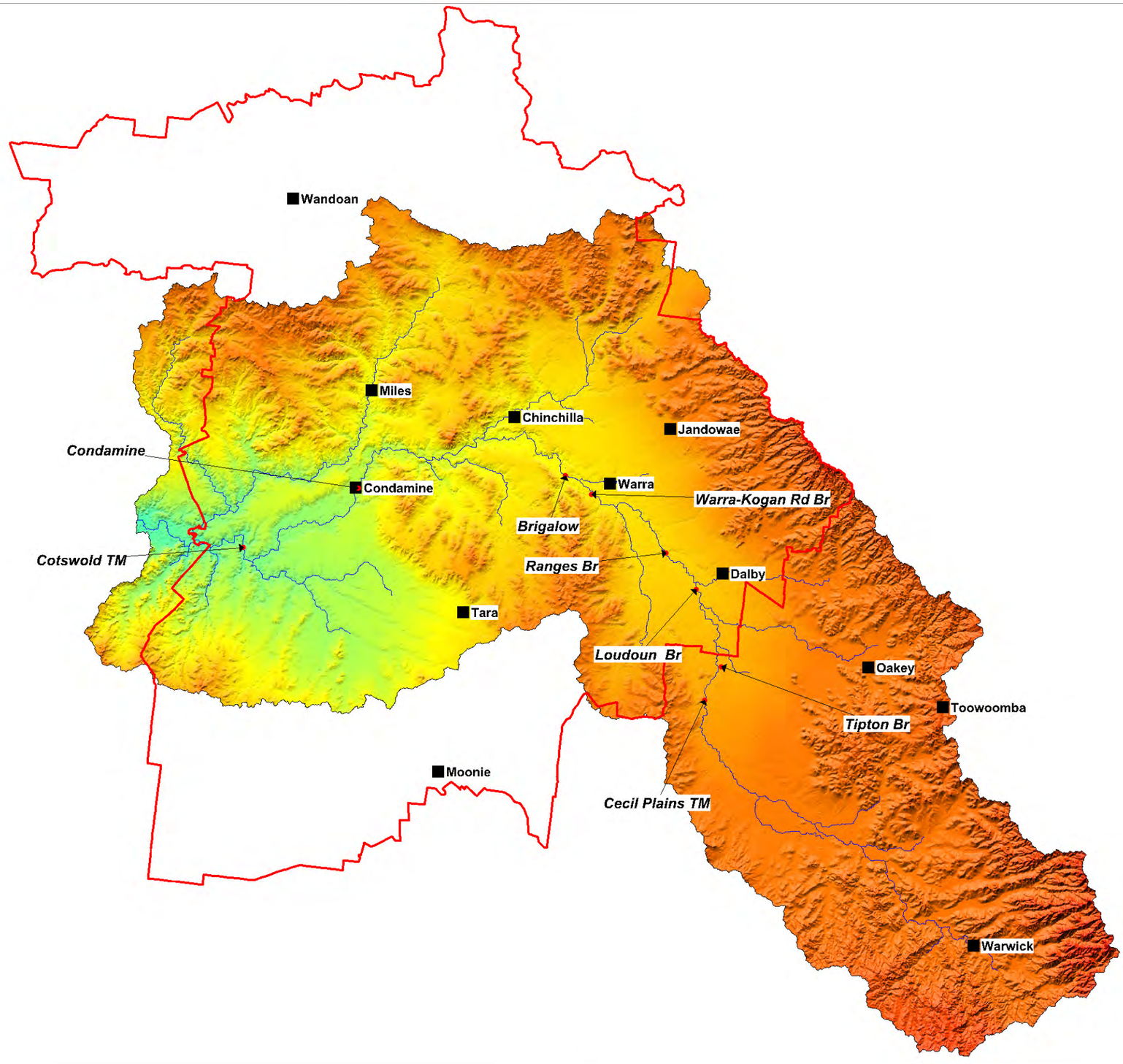

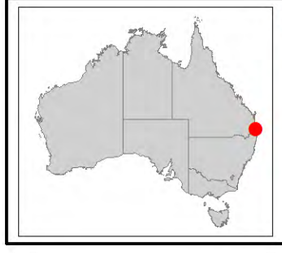

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Western Downs Regional Concil

Title:

Condamine River Catchment

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2.2 Dalby (Myall Creek)

Dalby is the principal town and administrative centre for the Western Downs region. It has a population estimated at 12,000 with a further 5,000 residing in the surrounding townships.

Myall Creek flows through the centre of Dalby in a south westerly direction and is a tributary of the Condamine River which it joins a further 12km downstream. Myall Creek drains the south west facing slopes of the Bunya Range and has an area of 1,375km^2. The catchment is characterised by a steep upper catchment, with the town of Dalby located on the flatter lower catchment floodplain.

The parts of the town lying to the north east are generally on higher ground with land to the west and the majority of land south of the creek being lower lying. There are three road crossings of the creek within the town:

- Patrick Street;
- Drayton Street (Warrego Highway); and
- Edward Street.

Figure 2-4 shows Dalby in the content of its upstream catchment.

A water level gauge located at Patrick Street Bridge is used to quote flood levels within the town. This gauge is shown in Figure 2-4 along with two other river level gauges located upstream in the catchment and used for flood warning purposes.

2.2.1 Flood History

Dalby has been subject to multiple flood events since records began in 1908. Recorded flood levels date back to 1942 and show major floods (those above 3.5m at Patrick Street gauge) in 1942, 1954, 1956, 1971, 1981, 1982, 2010 and 2011.

The largest flood on record occurred in 1981 reaching a gauge height of 4.5m resulting in 700 homes and 140 businesses being inundated and damage to 25,000 ha of agricultural land. Figure 2-3 illustrates the flood heights in Dalby.

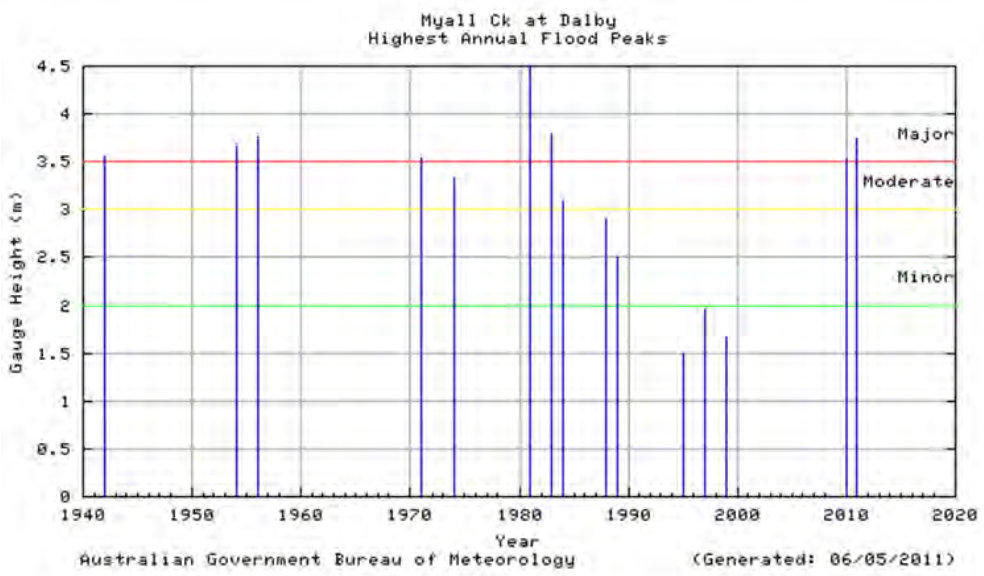
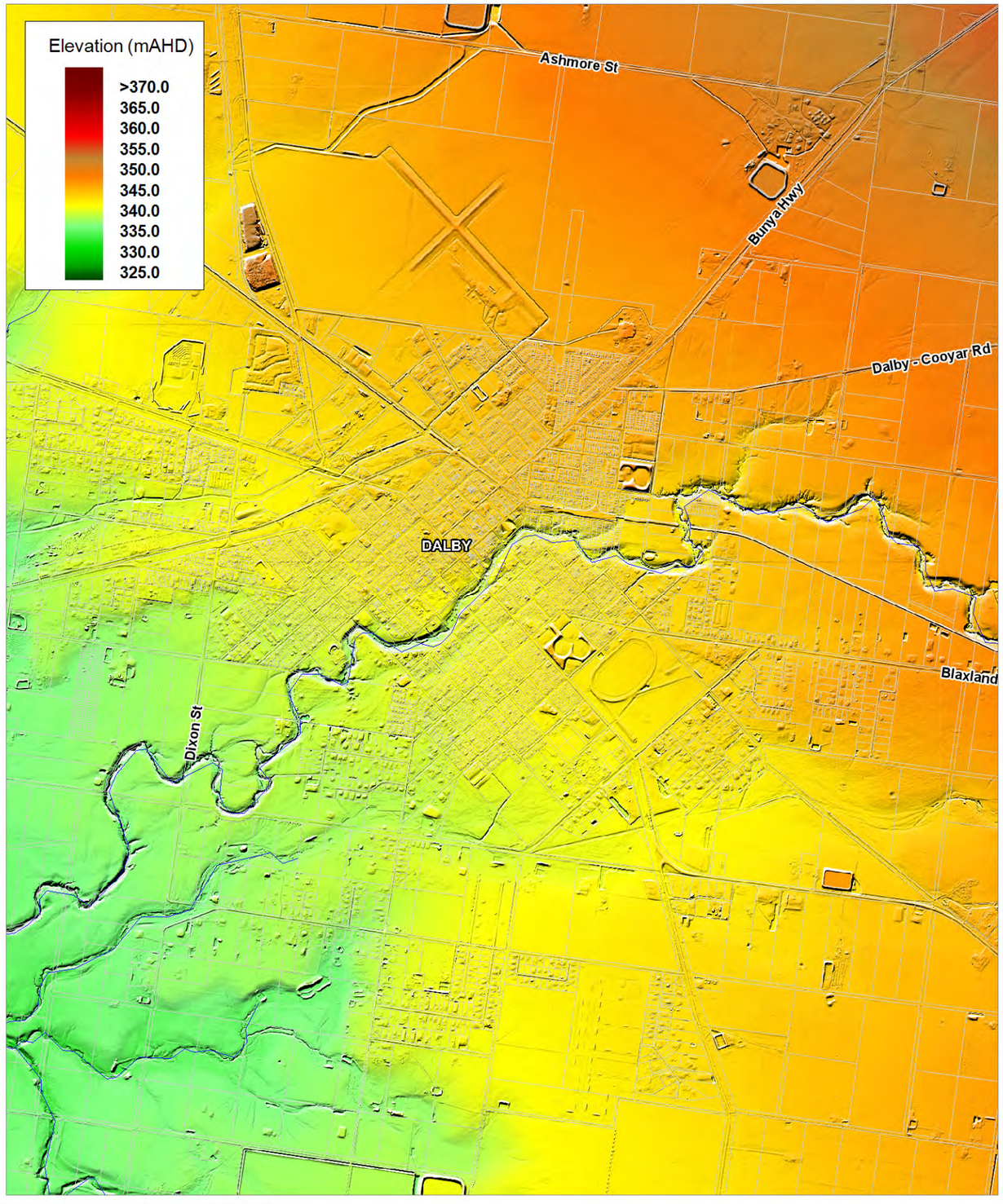
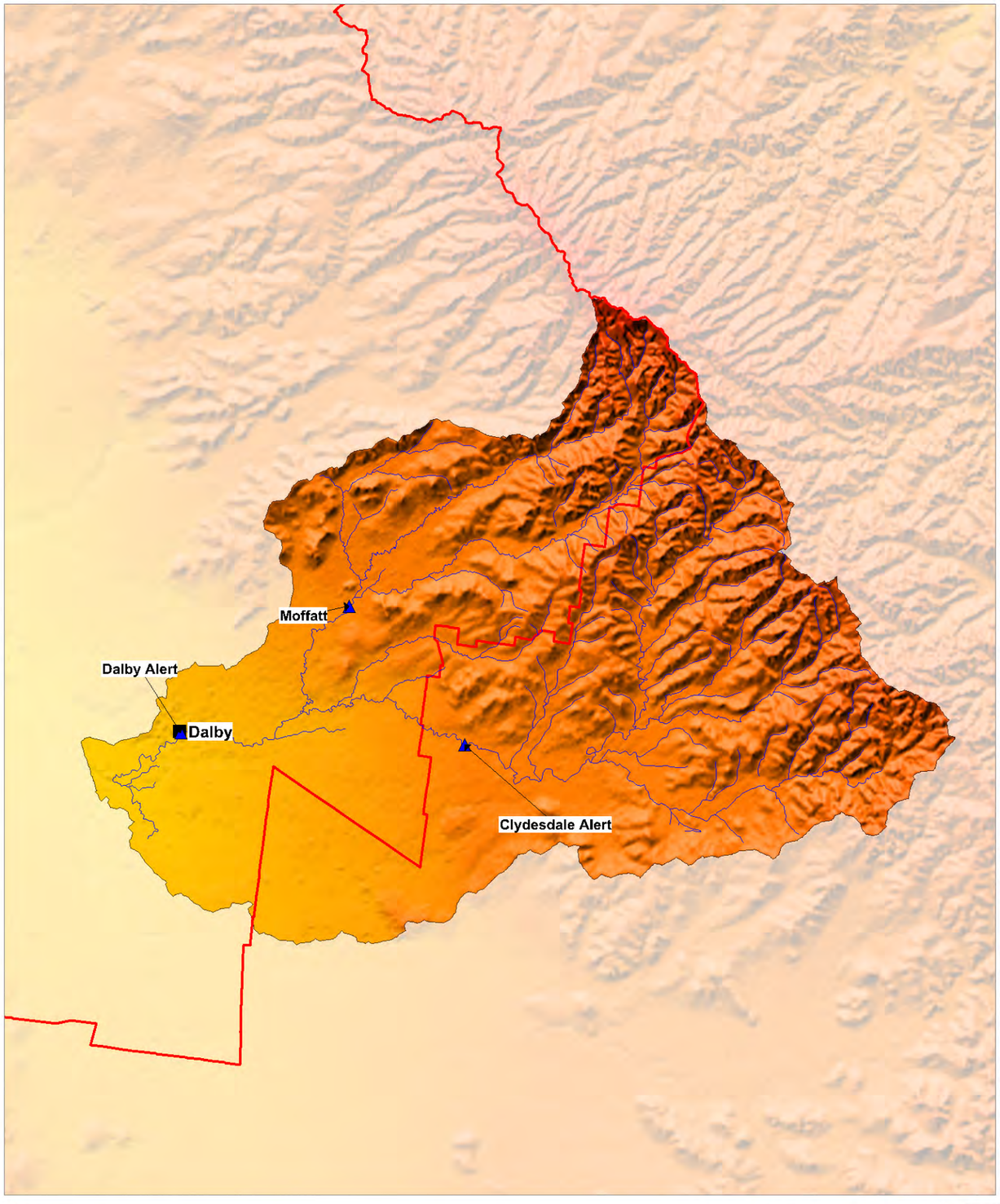


Figure 2-3 Recorded Flood Heights in Dalby (reproduced from BoM)





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Waterways

Cadastral Boundaries

Title:

Dalby (Myall Creek)

Figure: **2-4**

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Approx. Scale

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2.3 Chinchilla (Charley's Creek)

Chinchilla is located immediately to the east of Charley's Creek, a major tributary of the Condamine River which it joins a further 13km downstream. The town is situated at an elevation around 305mAHD and has a population of approximately 5,700 making it the second largest town in the Western Downs region.

Towards the south of Chinchilla, Charley's Creek combines with Rocky Creek and between them they have an upstream catchment area of approximately 3,800km^2.

There is one major road crossing of Charley's Creek which is for the Warrego Highway.

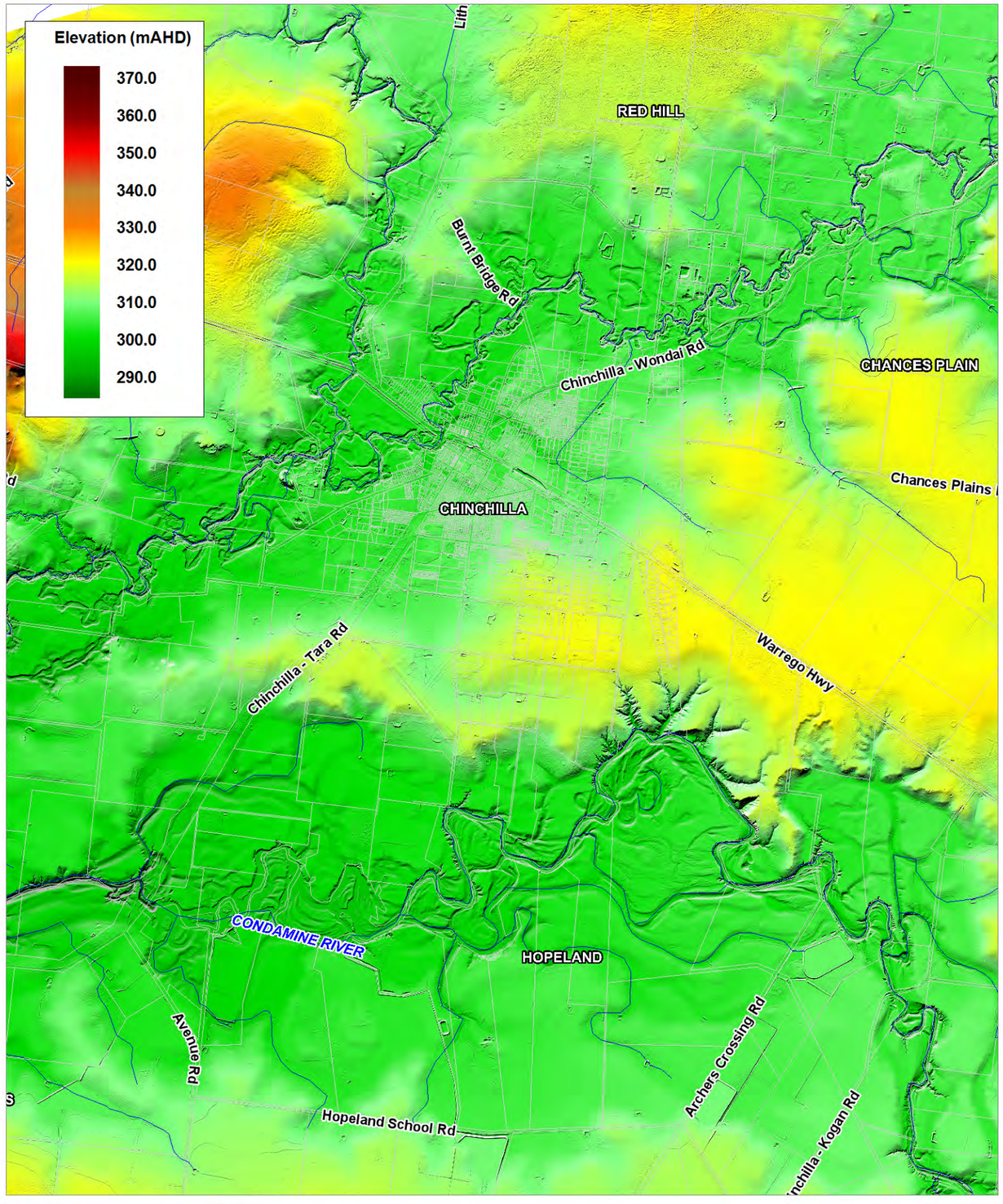
To the south of Chinchilla on the Condamine River is Chinchilla Weir which was constructed in 1973 and has the dual purpose of supplying irrigation water for agriculture and augmenting the water supply to Chinchilla. A water level gauge is located at the weir and forms part of the Condamine flood warning network.

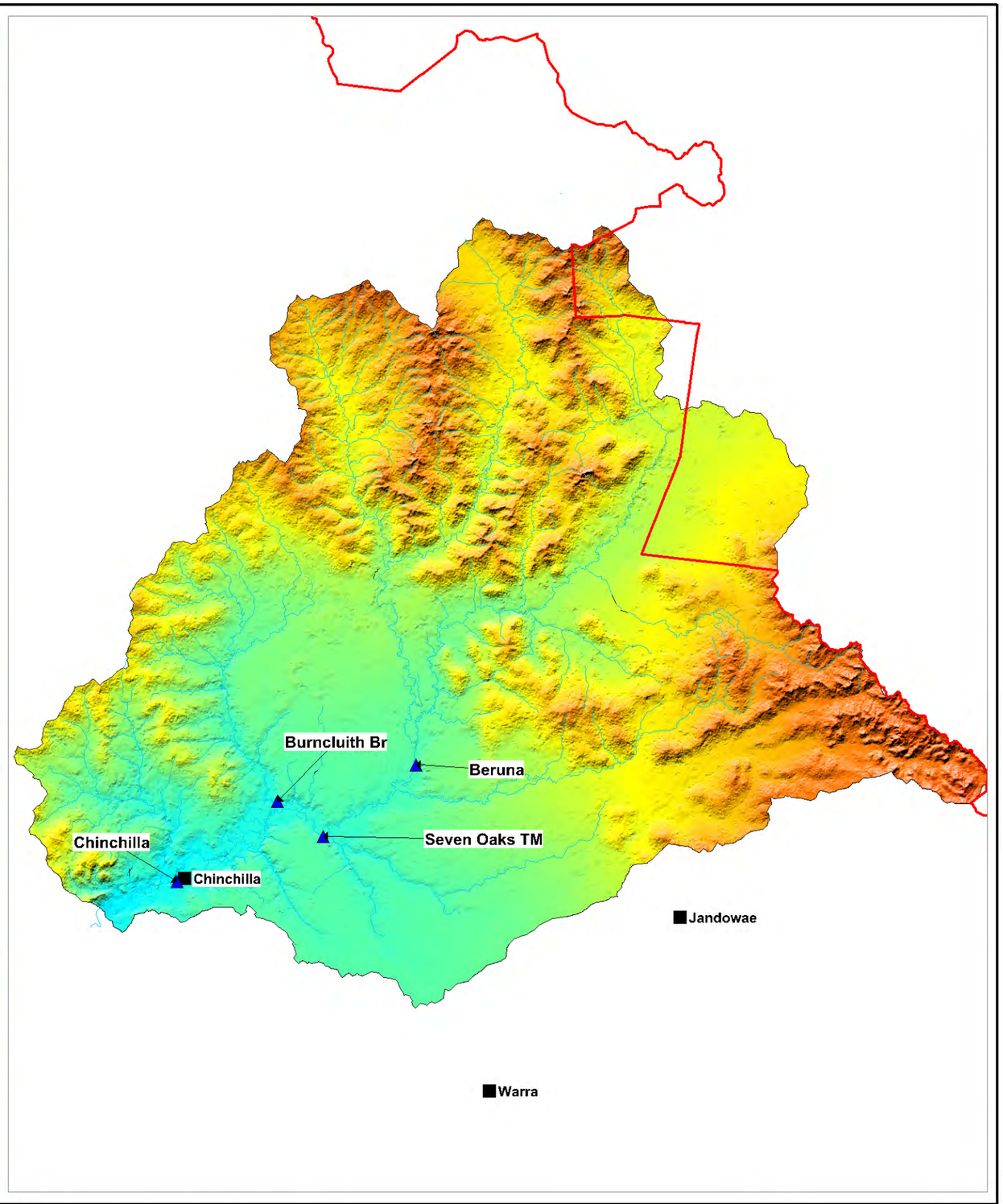
The 1% AEP (100 year ARI) flood extent mapped by Water Technology shows a significant amount of inundation in the north western parts of Chinchilla. The south eastern part of the town is largely raised up out of the 1% AEP floodplain.

There are three stream gauging stations on Charley's Creek upstream of Chinchilla providing records of stream flow within the catchment and a further gauge in Chinchilla itself. These gauges are shown in Figure 2-5 and discussed further in section 4.1 on Flood Warning.

2.3.1 Flood History

Significant floods have occurred in Chinchilla in 1942, 1983 and 2010. The highest on record was in 1942 when a level of 8.20m was reached at Charley's Creek Bridge. The double flood event of Dec 2010 / Jan 2011 resulted in peak levels of 7.25m and 7.45m respectively which have only be exceeded by the 1942 flood in recorded history. The flood in 1983 is now the fourth largest on record at 7.03m.





LEGEND

Waterways

Cadastral Boundaries

Title:
Chinchilla (Charley's Creek)

Figure: **2-5**

Rev: **A**

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2.4 Miles (Dogwood Creek)

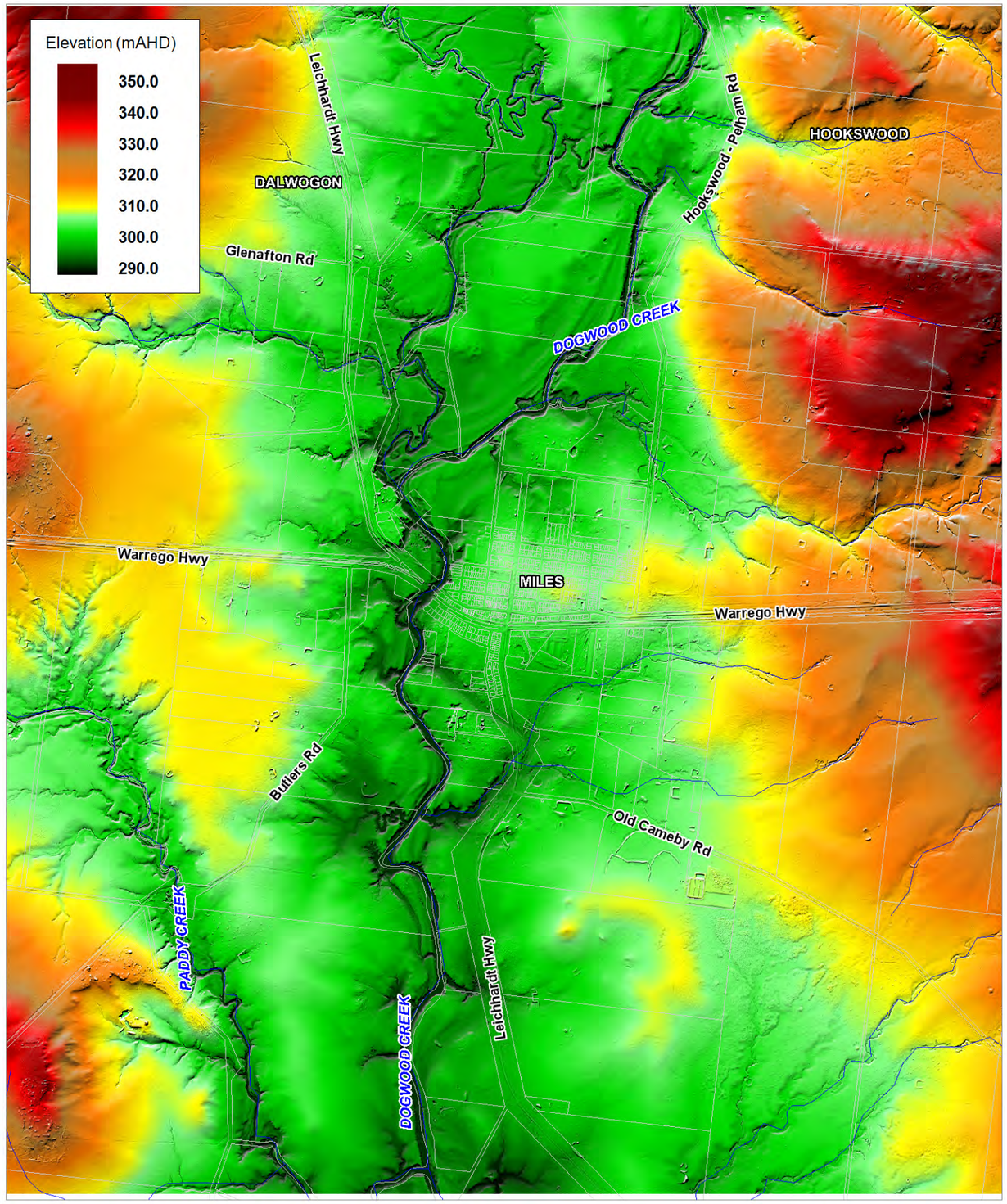
Miles is located in the middle reaches of the Dogwood Creek catchment, a major tributary of the Condamine/Balonne River system. The town located to the east of the southerly flowing creek and has a population of around 1,200. The majority of the town is suitably elevated to be outside of the immediate floodplain of the creek although the town has the potential to be affected by localised runoff from the hills to the east. Figure 2-6 shows miles in the context of its wider catchment.

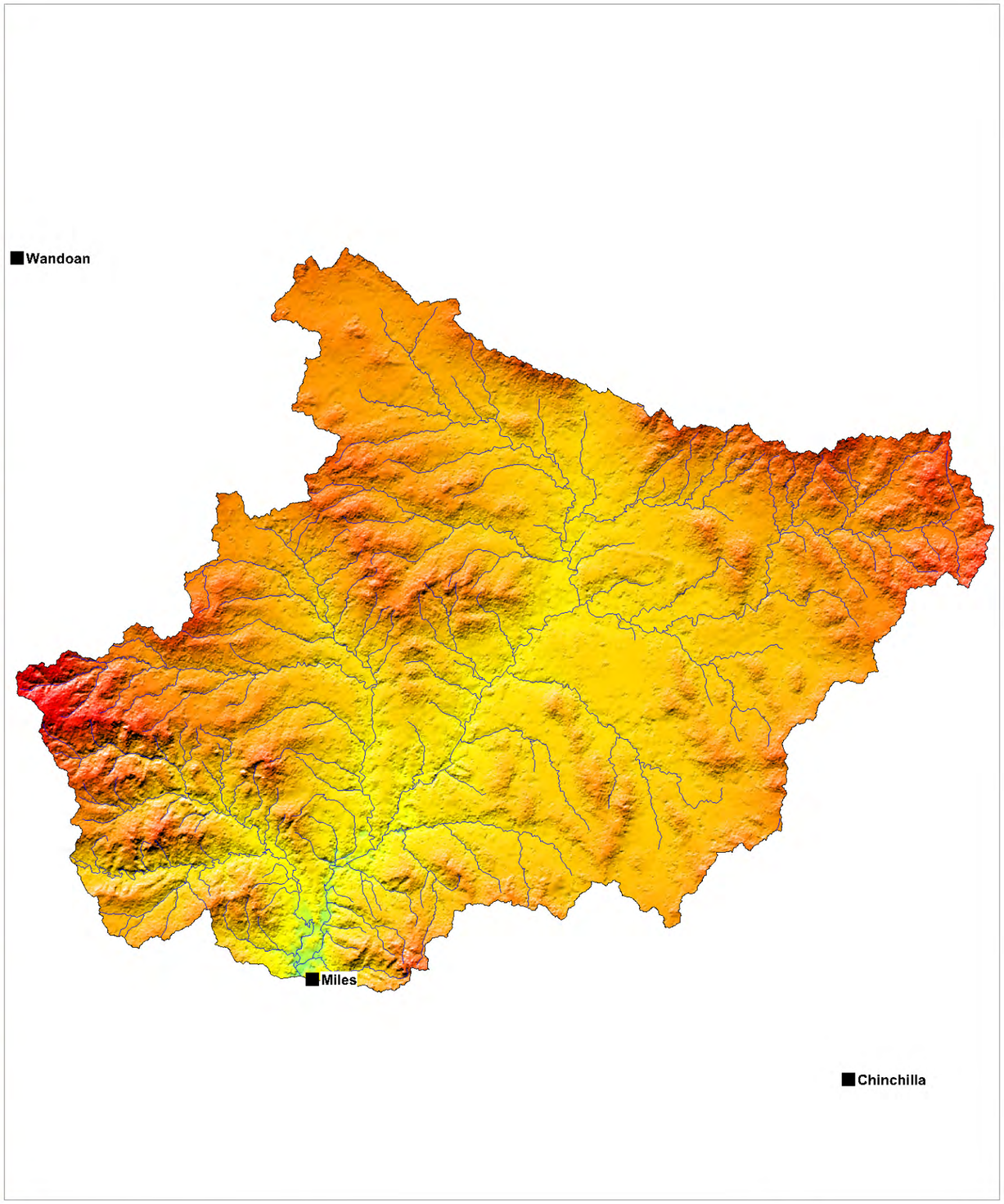
Dogwood Creek itself is 80km long to Miles and has a catchment area of approximately 2,600km2 upstream of Miles. A key tributary of Dogwood Creek is Wallen Creek. Whilst not as long as Dogwood Creek, (Wallen Creek has a length around 30km) it is steeper and is likely to respond quickly to rainfall events.

The 100 year ARI flood extent for Miles shows inundation to the lower lying western extent of the town. The majority of the town remains flood free during this event.

2.4.1 Flood History

The largest known flood in Miles occurred in 1956 with a level of 14.02m at the Gil Weir gauge. The more recent 2010/11 flood peaked at Gil Weir at 13.11m (12.1m at the Warrego Highway bridge gauge). Due to lack of significant property inundation high creek levels are not as comprehensively documented as in other localities.





LEGEND

Waterways

Cadastral Boundaries

Title:
Miles (Dogwood Creek)

Figure: **2-6**

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2.5 Jandowae (Jandowae Creek)

Jandowae is located at the foothills of the Dividing Range and has a population of around 1,000. Jandowae Creek flows in an easterly direction through the centre of the town and has an upstream catchment area of 220km^2. The creek is approximately 45km long to Jandowae dropping 292m over its length. Mount Creek is the major tributary of Jandowae Creek which joins it from the north 16km upstream of Jandowae. Downstream of Jandowae the creek joins the Cooranga Creek immediately upstream of Warra before joining with the Condamine River. Figure 2-7 shows Jandowae in the context of its wider catchment.

Due to the location of the creek within the town centre the town is particularly vulnerable to flooding. The 1% AEP (100 year ARI) flood extent mapped by Water Technology shows significant inundation across the majority of the town.

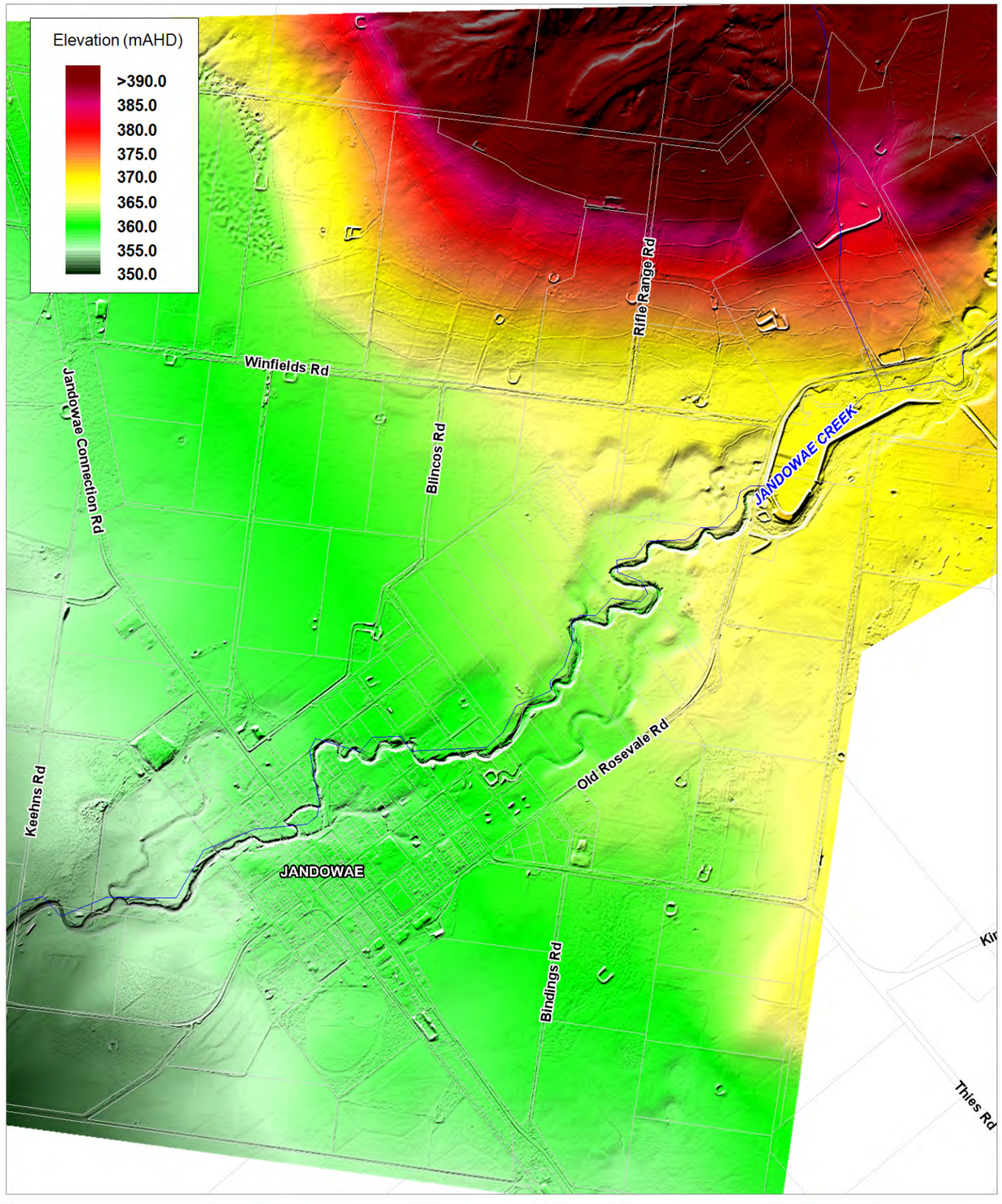
It is understood that there is no official flood warning system in place for Jandowae.

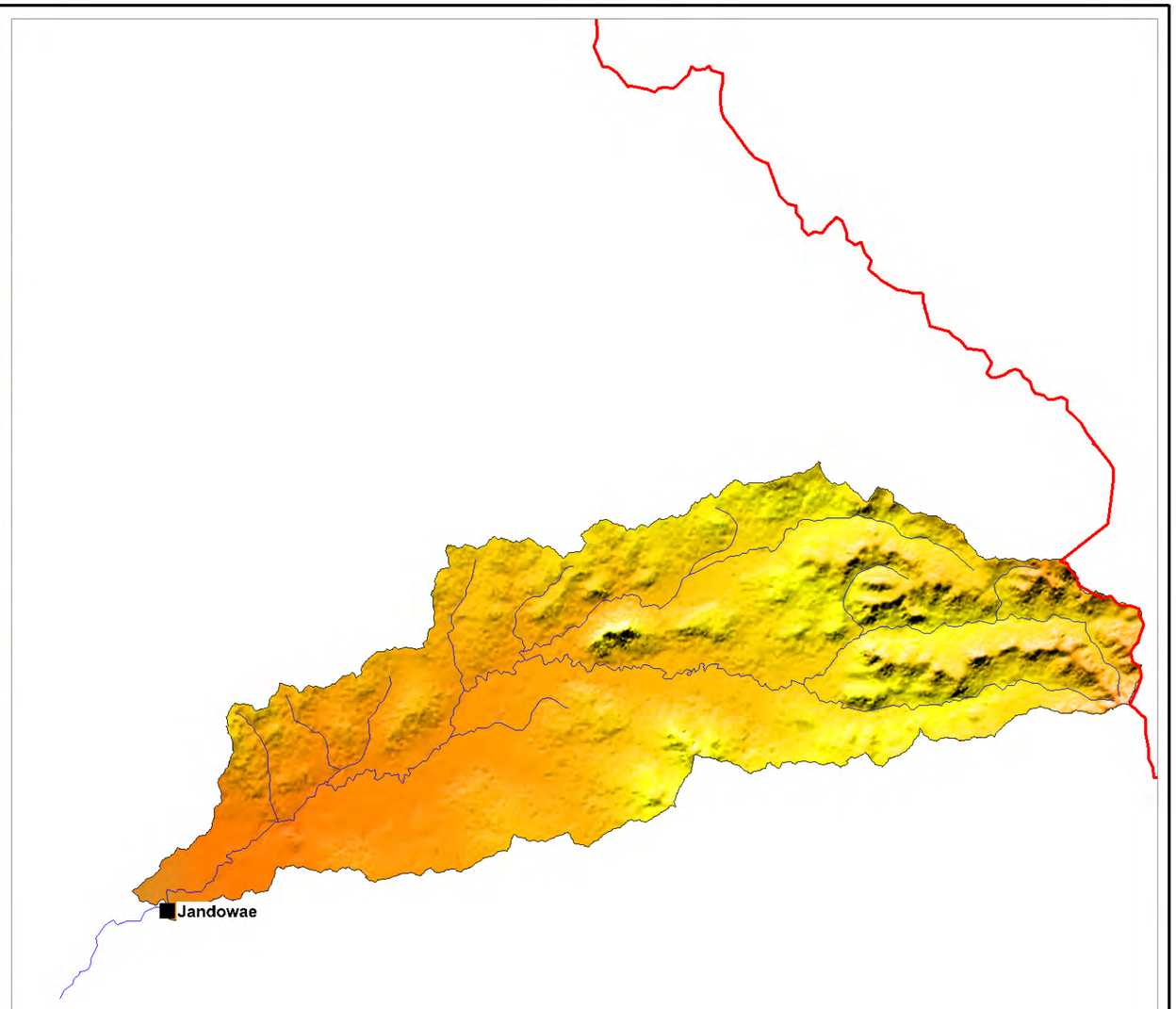
2.5.1 Flood History

Due to the creek flowing through the centre of Jandowae there is a history of flooding within the town.

As part of Council's Planning Scheme Review (PSR) a flood report was prepared (Water Technology, 2011) and notes one significant flood event in Jandowae in 2011. It notes that this was the largest in living memory based on anecdotal sources.

Information supplied by the SES note other floods in the town in 1942, 1956 and 1981 with both the 1942 and 1981 floods being larger than that of 2011, the peak of 1942 being approximately 2.9m at the gauge. A further flood occurred in the town in November 2007 following 111mm of rainfall in one night. The flood inundated a large section of the town and cut all roads to and from the town.





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Waterways

Cadastral Boundaries

Title:
Jandowae (Jandowae Creek)

Figure: **2-7**

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2.6 Wandoan (Juandah Creek)

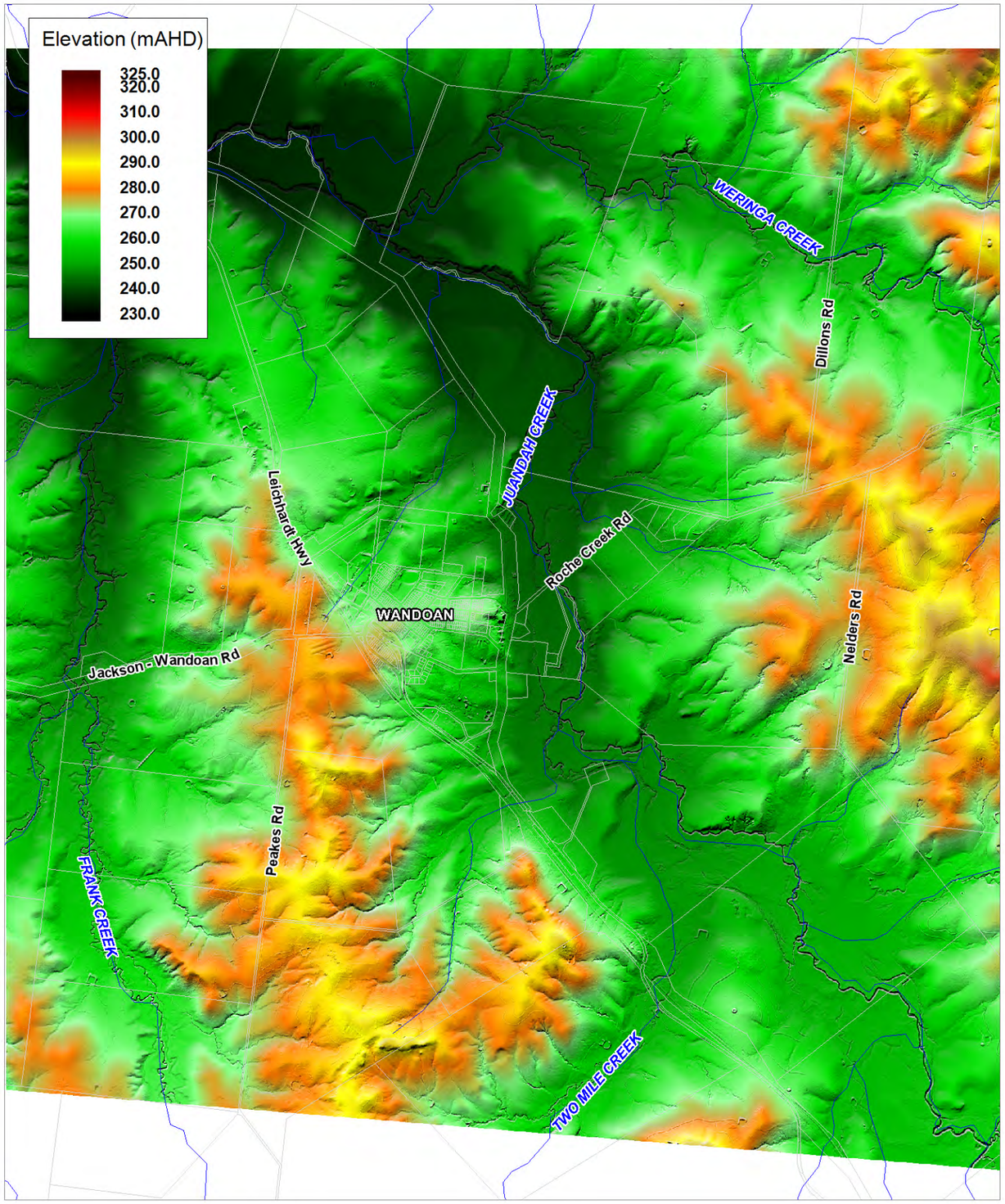
Wandoan is located west of Juandah Creek, a headwater tributary of the Dawson River which eventually joins the Fitzroy River. Juandah Creek has an upstream catchment area (from Wandoan) of approximately 600km^2. The catchment divide between Juandah Creek and the Condamine to the south forms part of the main drainage division along the east coast of Australia. Figure 2-8 shows Wandoan in the context of its wider catchment.

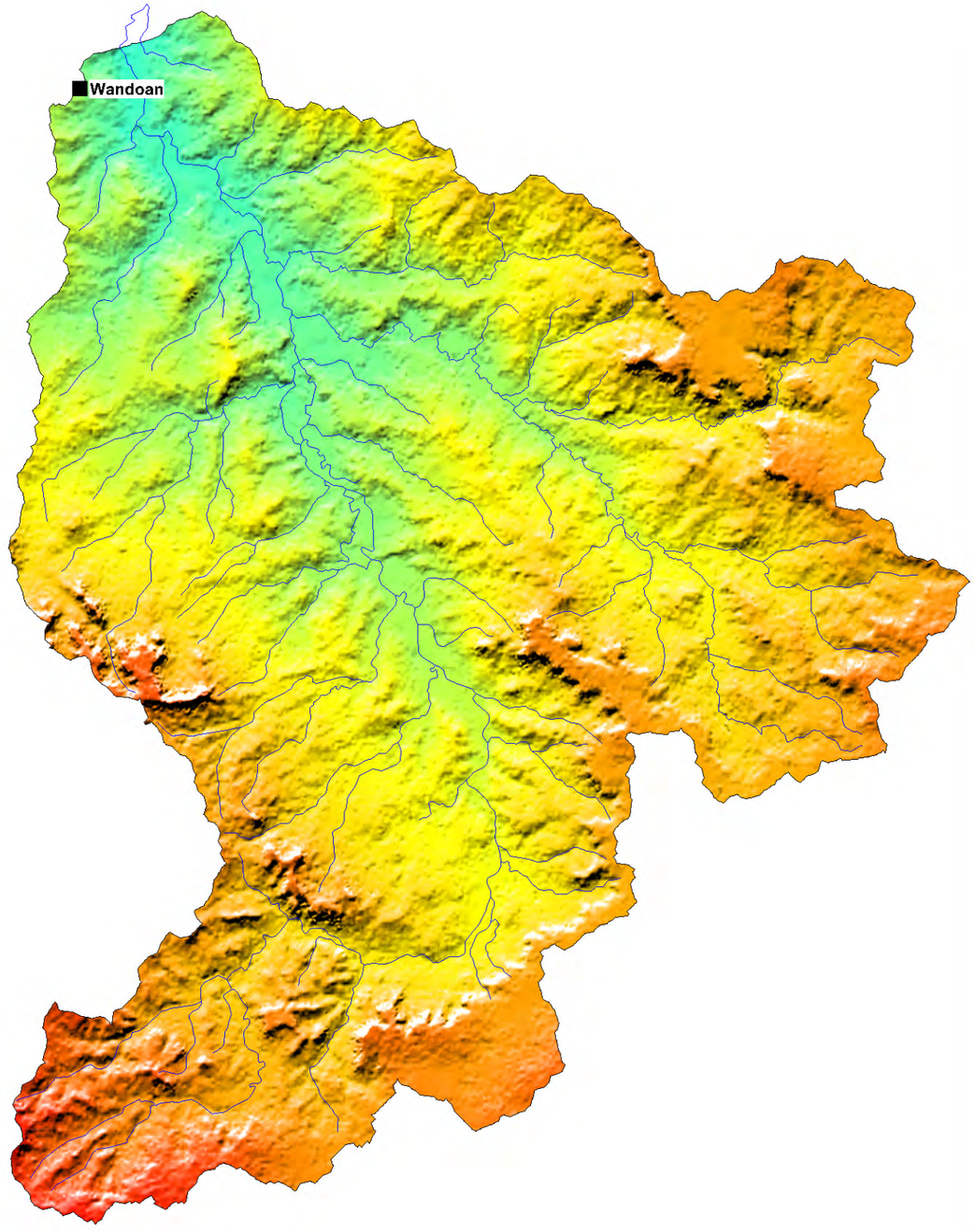
The catchment has a relatively wide upstream area with many minor tributaries feeding the main drainage routes. Wandoan itself is raised out of the immediate floodplain and lies outside of the 100 year ARI flood extent as illustrated in the Water Technology 2011 report. It is likely that the main issue for the town with regard to flooding is one of isolation due to the potential for floodwaters to cut the Leichhardt Highway and the Jackson-Wandoan Road.

It is understood that there is no official flood warning system for Wandoan.

2.6.1 Flood History

There is no documented history of property flooding in Wandoan but that is not to say that previous floods have not occurred.





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Waterways

Cadastral Boundaries

Title:
Wandoan (Juandah Creek)

Figure: **2-8**

Rev: **A**

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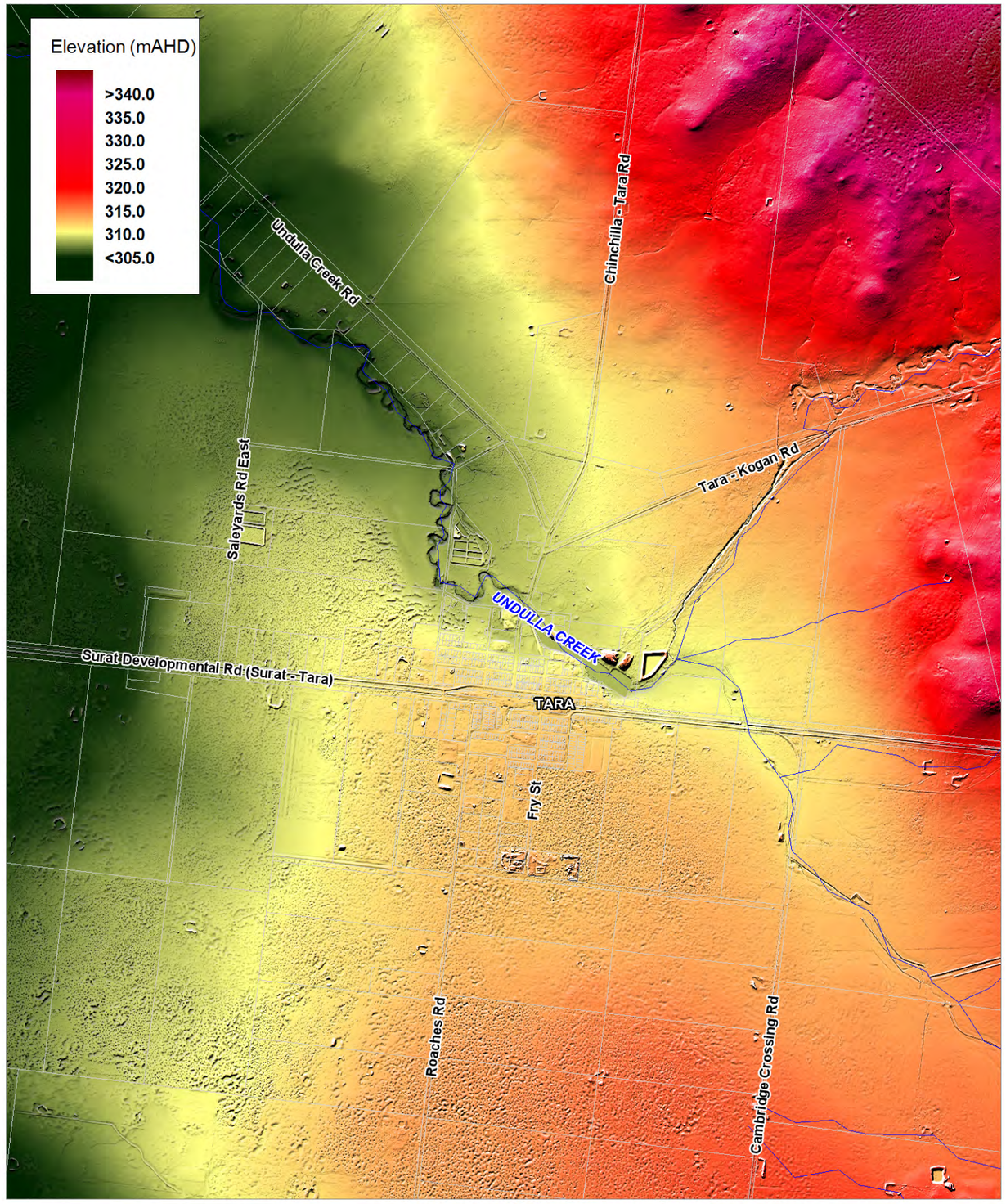
2.7 Tara (Undulla Creek)

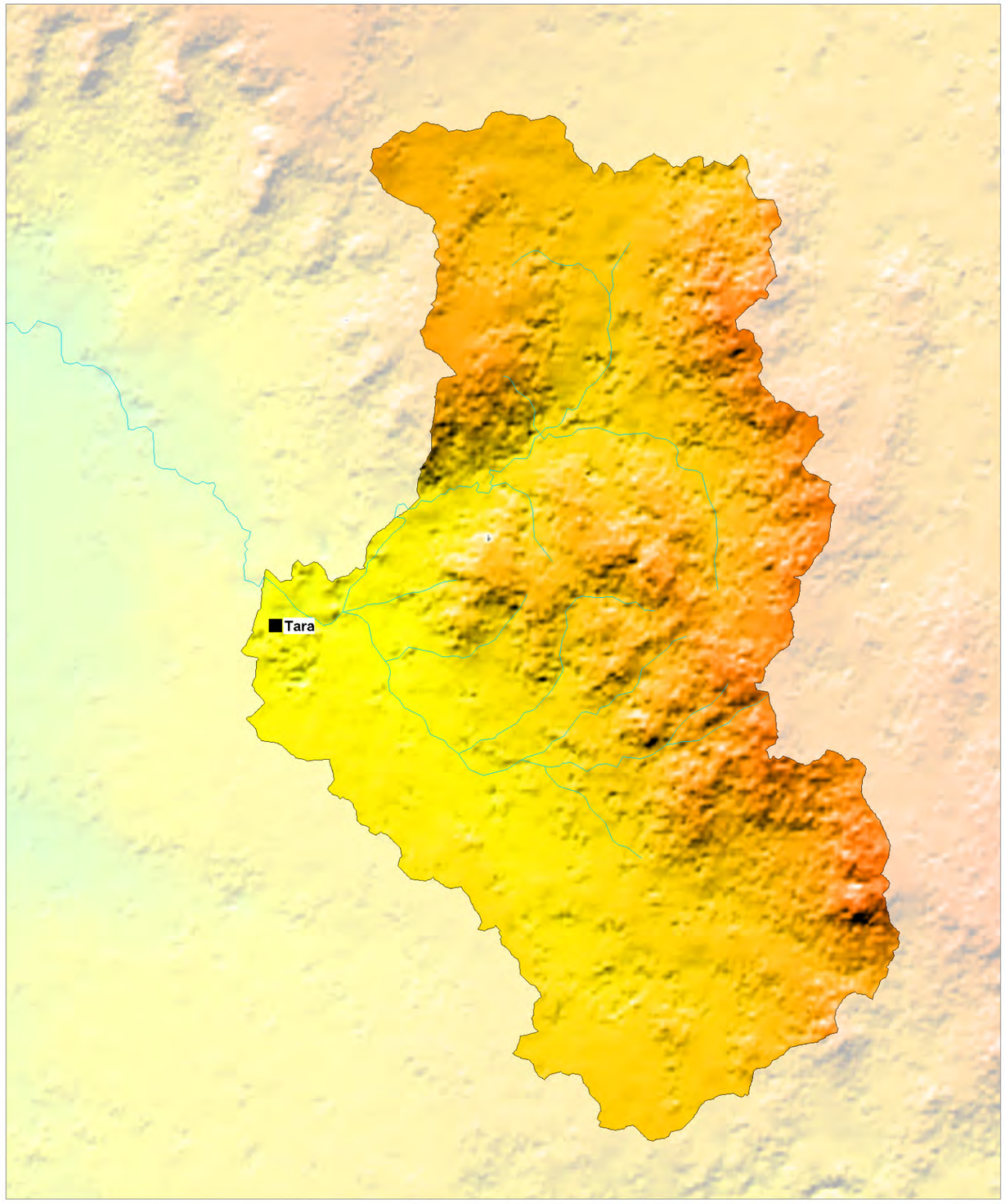
Undulla Creek flows through to the immediate north of Tara. It has a relatively small upstream catchment of 140km^2 and therefore flooding may occur very soon after heavy rainfall. The majority of the town is located outside of the 1% AEP (100 year ARI) flood extent based upon recent mapping undertaken by Water Technology although properties fronting the creek may be vulnerable to flooding. The main issues are likely to be associated with isolation following the cutting of roads into the town. With a small upstream catchment area the floods are unlikely to be of a significant duration. Figure 2-9 shows Tara in the context of its wider catchment.

Of note in 1985 a levee bank was constructed upstream of the Tara-Chinchilla Road. It is not known what standard of protection this levee bank provides. Further levees have been constructed on an ad-hoc basis to protect individual properties near the lagoon.

2.7.1 Flood History

Historic flooding is noted in 1996, 1998 and 2001 and it was observed that floods generally clear the town after one or two days (TSC, 2002). The significant flood event of December 2010 caused prolonged inundation of roads for a period of 7-10 days which is significant for a relatively small catchment.





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Waterways

Cadastral Boundaries

Title:
Tara (Undulla Creek)

Figure: **2-9**

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2.8 Warra (Cooranga Creek)

The Cooranga Creek flows to the north of Warra in a westerly direction before joining the Condamine River approximately a further 10km downstream. Immediately upstream of Warra the Jandowae Creek combines with Cooranga Creek. The total upstream catchment area draining to Warra is of the order of 950km^2 and when in flood the creek has the potential to cut the Warrego Highway on the northern side of the town.

It should be noted that no flood mapping currently exists for Warra.

2.8.1 Flood History

No details have been located on the flood history of Warra. Based on its location it has presumably been subjected to multiple flood events throughout its history. The only event that is documented is that which occurred in the summer 2010/11 floods when a large part of the town was inundated.

2.9 Condamine

Condamine is a town with a population of approximately 140 located immediately to the east of the river of the same name. The upstream catchment area is very large at around 24,800km^2 which provides the potential for significant flow to pass by the town. It is noted that heavy rainfall over any one of the Condamine River's larger upstream tributaries may cause flooding in the town.

Isolation during flood events is an issue for the town as when the river is in flood it can remain high for a number of days or even weeks.

There is one crossing of the river which is for the Leichhardt Highway.

Due to its large upstream and gauging network there is a relatively good flood warning system in place that can monitor the progress of upstream floodwaters as they pass down the river.

It should be noted that no flood mapping currently exists for Condamine Town.

2.9.1 Flood History

The Condamine River floods on a regular basis with the most significant floods occurring in 1942, 1956, 1983, 1996 and 2010/11. The 2010/11 flood consisted of two events two weeks apart with the first event being the largest on record at Condamine. Figure 2-10 plots the recorded levels on the Condamine within the town.

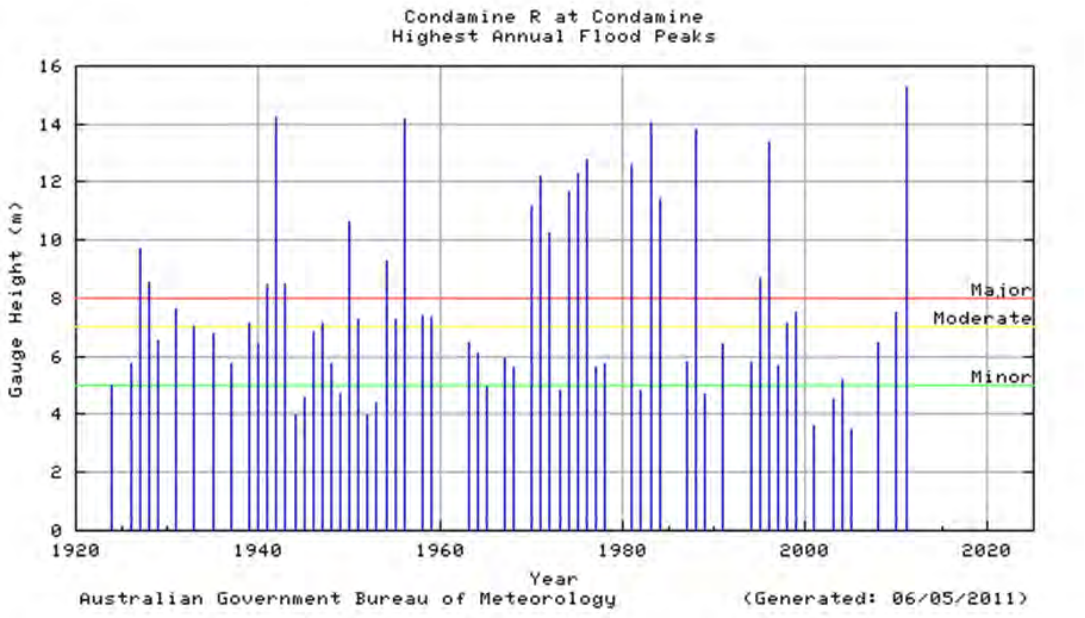

Figure 2-10 Recorded Flood Heights in Condamine (reproduced from BoM)

3 SUMMER 2010 / 2011 FLOODS

Between 300mm and 600mm of rainfall was recorded over the Condamine River and nearby creeks during December 2010. Further heavy rain was recorded in early January 2011 with falls between 200mm and 400mm.

The rainfall triggered multiple flood events throughout the region and the area was declared a disaster zone on 28 December 2010. In total approximately 200 homes and nearly 90 businesses were flooded across the region. Many towns that did not flood were affected through factors such as isolation as key transport routes were cut by floodwater. Interruptions to the power supply, water treatment operations and mobile communication networks exacerbated the impacts across the region.

Brief summaries of the summer 2010/11 flooding and subsequent impacts are provided below for 8 of the main affected areas.

3.1 Dalby

The town of Dalby was subjected to three distinct flood events between December 2010 and January 2011. The third event on 11 January 2011 was severe and was the 5th highest on record in Dalby with a gauge height of 3.74m (the highest being in 1981 when the gauge reached 4.5m). On each occasion the flooding was due to heavy rainfall within the Myall Creek catchment rather than backwater flooding from the Condamine River. Figure 3-1 plots recorded rainfall daily totals at locations within the Dalby Catchment. Gauge locations are shown in Figure 3-2. It should be noted that daily totals are recorded at 9am and represent the accumulated rainfall in the 24 hours up to 9am.

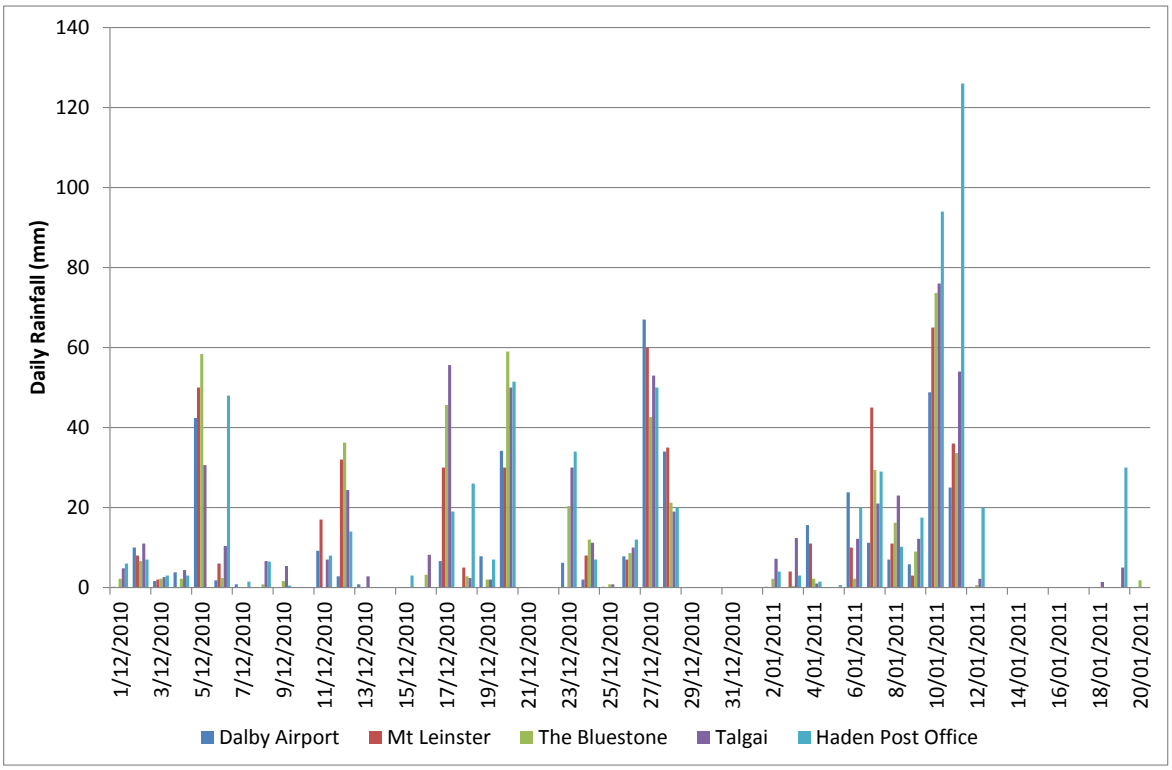

Figure 3-1 Selected Daily Rainfall Totals in the Myall Creek Catchment

Figure 3-2 Selected Daily Rainfall Gauges – Myall Creek Catchment

Figure 3-3 shows the recorded flood levels in Dalby at the Patrick Street Gauge. The three events which affected Dalby in Dec 2010 and Jan 2011 can clearly be distinguished.

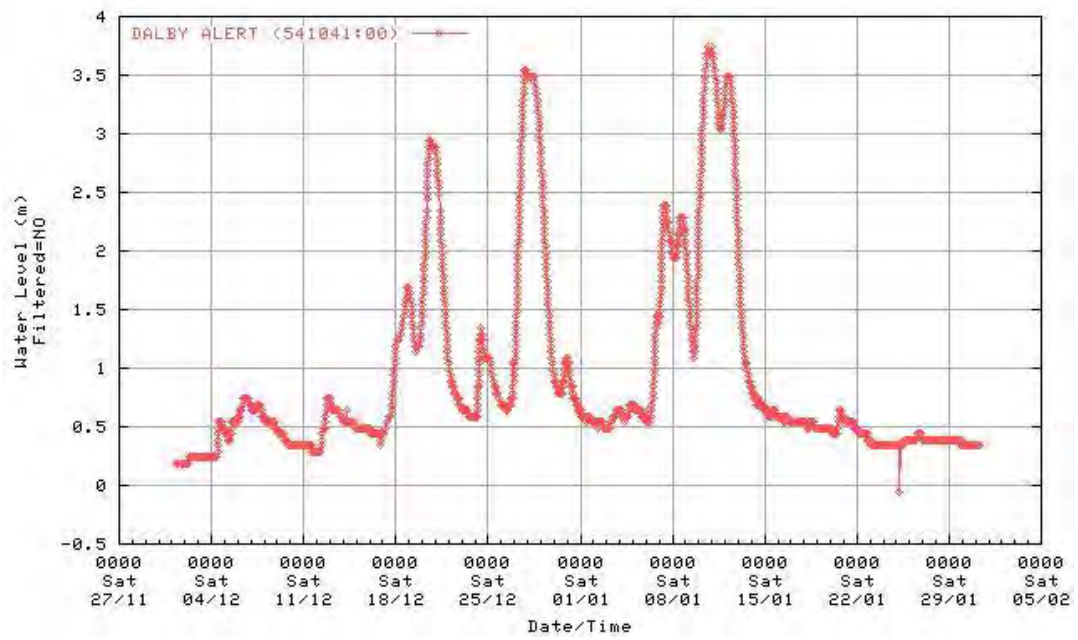

Figure 3-3 Myall Creek at Dalby Flood Levels (Dec 2010 – Jan 2011)

3.1.1 Event 1 (20 December 2010)

The Myall Creek catchment experienced a series of minor events preceding a *moderate* flood event of 2.94m on 20 December 2010. The event resulted in multiple road closures and some 30 properties were reported as being inundated by the creek as well as stormwater surcharging to varying degrees. Flood waters rose steadily in the 24 hours preceding the event, before peaking and

returning to normal levels by December 22. Power failures occurred across the town, with power restored to all properties by noon on 22 December 2010.

Principal road closures included Dalby-Cooyar Road, Dalby-Cecil Plains Road, Dalby-Jandowae Road, Blaxland-Irvingdale Road, Dalby-Nungil Road and Dalby-Kogan Road.

Patrick Street Bridge over Myall Creek is reported to surcharge at a flood level of 2.0m. The bridge became surcharged on the morning of 20 December, cutting access across.

3.1.2 Event 2 (27 December 2010)

In the lead up to Christmas more rain fell and Myall Creek quickly rose again causing more significant flooding on 27 December 2010, reaching a height of 3.54m. This level is classified as *major* in terms of previous records for Dalby. This event also caused a greater number of properties to be affected in the north west of Dalby which had previously only experienced minor disruptions due to floodway road closures. Roads were again flooded throughout much of Dalby, with the Warrego Highway also flooded and cut at Jondrayan. The water in the north west area of town peaked several hours before the recorded peak and was sustained for much of this event. In total 57 homes were reported to have been inundated by this second event.

Between 28 December 2010 to 9 January 2011 there were further minor to moderate events. Most notable during this time was the fact that the Condamine River rose to at least 11.2m, inundating Dalby's water treatment plant on 28 December 2010 to a depth of approximately 0.5m. The plant was shut down by the flood and the town was put on Level 6 water restrictions, with water tanked in by road to supplement supplies. The water treatment plant was partially restored on 1 January 2011, returning to full operations after 15 January 2011. Figure 3-4 shows the recorded flood levels for the Condamine River at Loudoun Bridge near Dalby. It was the first peak which caused the initial inundation of the water treatment plant.

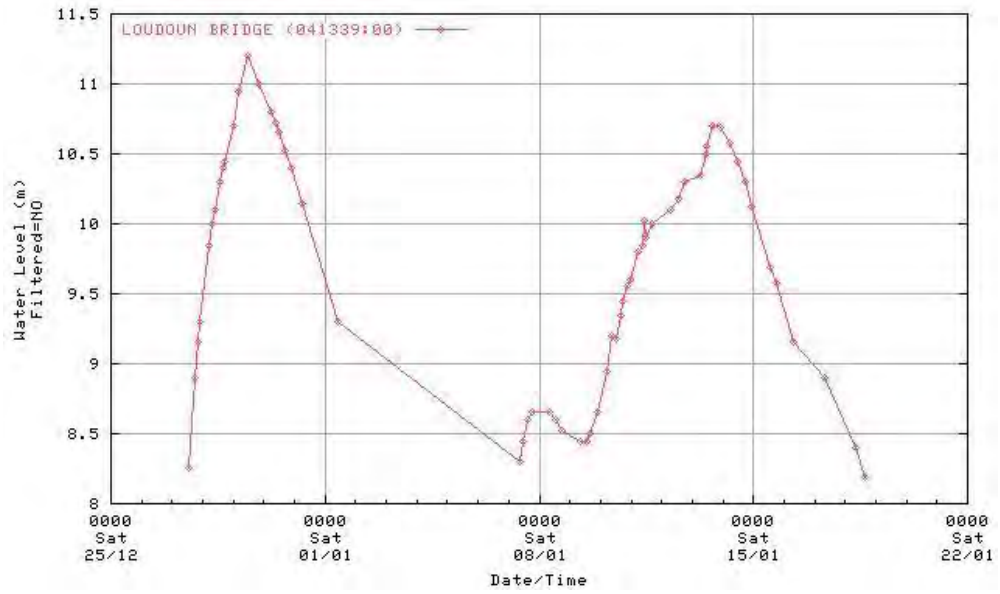

Figure 3-4 River Condamine at Loudoun Bridge near Dalby

3.1.3 Event 3 (10 January 2011)

Heavy rainfall fell on 9 January 2011 in the upper Clydesdale and Moffatt catchments upstream of Dalby. The resulting flooding on Myall Creek of the 10 January 2011 was recorded at a peak level of 3.74m, the third highest recorded flood event since records began. The north west area of town peaked below the level recorded on 27 December 2010 and peaked several hours after the recorded main peak. By the 11 January 2011, Loudon Bridge on the Condamine River reached 9.94m, reducing the highway to a single lane.

The extent of the flooding in this event broadly matched the 100 year ARI outline produced in the Myall Creek Flood Study (SKM, 2007). Over 160 residents were evacuated and 93 homes were reported to have been inundated during the third event.

By the 13 January 2011, the Condamine River had again risen to a peak of approximately 10.7m (see Figure 3-4), inundating Dalby's water treatment plant for a second time and causing Level 6 water restrictions to be put in place.

3.2 Chinchilla

There were two separate flood events that impacted Chinchilla, one on 28 December 2010 and the second on 12 January 2011. Hydrographs clearly showing two events are provided in Figure 3-5 and Figure 3-6 for Charley's Creek and the Condamine River respectively.

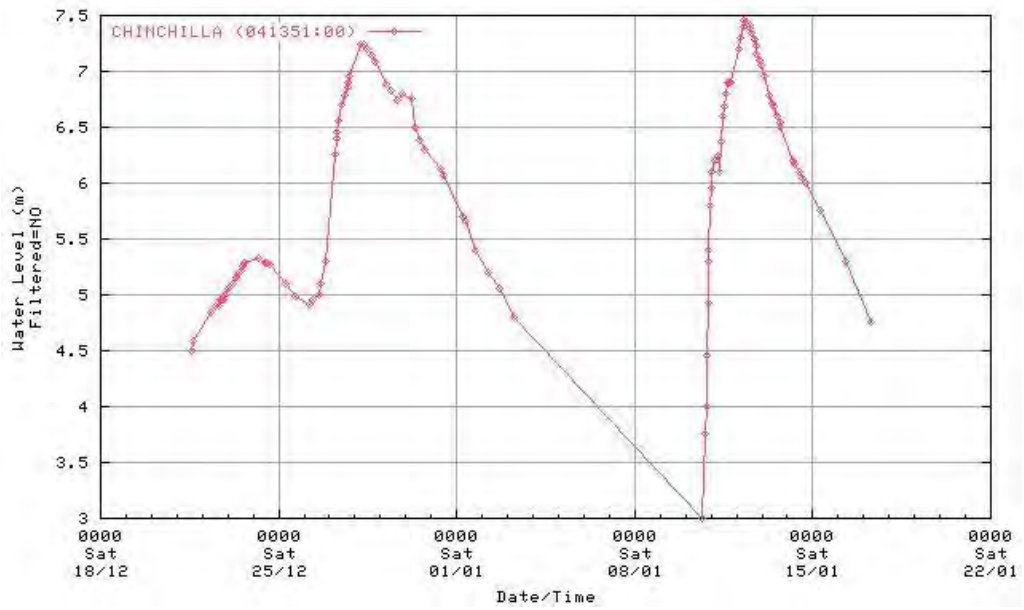

Figure 3-5 Charley's Creek at Chinchilla Flood Levels (Dec 2010 – Jan 2011)

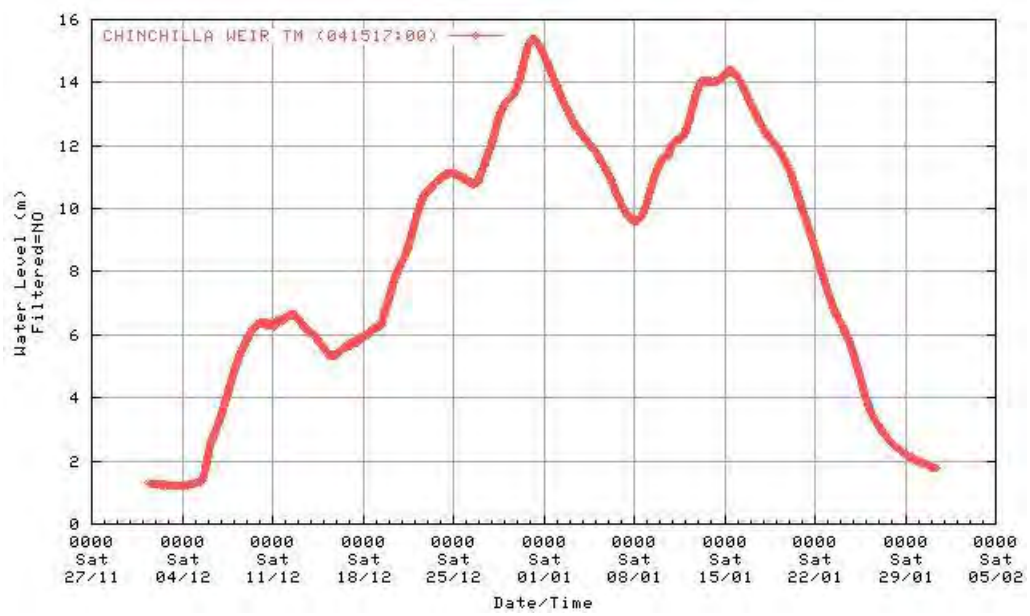

Figure 3-6 Condamine at Chinchilla Weir Flood Levels (Dec 2010 – Jan 2011)

Charley's Creek Bridge first went underwater on 23 December 2010 following a period of heavy rain in the preceding days. On 26-27 December 2011, a further 60mm rainfall across an already saturated catchment caused flooding in Chinchilla and overtopped Charley's Creek Bridge, cutting the Warrego Highway between Miles and Dalby. On 28 December 2010 the gauge height at Charley's Creek bridge measured 7.25m, the highest recorded flood since 1981. 36 properties were inundated by floodwaters and 20 people were evacuated. Charley's Creek remained at major flood level until 1 January 2011. Evacuated residents started to return home on 5 January 2011.

Further heavy rain on 10 January 2011 preceded the second flood event on 12 January 2011 where the gauge height recorded was 7.45m. This event was the second highest flood level recorded in Chinchilla's history exceeded only by the 1942 flood. The Chinchilla water treatment plant was inundated and over 240 homes were left without power. Council's record of the flood events indicate that 263 properties were affected by floodwaters within Chinchilla to some degree.

3.3 Miles

There was one major flood event in Miles which peaked on 28 December 2010 at 12.1m at RJ Simmons Bridge (Warrego Highway). The bridge was reopened on 30 December. It was observed that the railway bridge did not go under.

Much of Miles is raised outside of the immediate floodplain and as a result flooding to property was limited with Council records indicating that three properties were inundated by floodwaters in Miles (one in the town and a further two within the district). The peak flood level was lower than that recorded in 1983 although anecdotal evidence suggests that some of the upstream tributaries had higher flood levels than in 1983.

At the peak of the flood all roads into the town were cut causing issues of isolation. However the town did not experience significant outages of power or problems with the water supply system like some other localities.

Once flood water receded there was structural damage to a number of main roads. Wallen Creek which joins Dogwood creek to the north of Miles caused significant damage to the Leichhardt Highway affecting travel to and from Wandoan.

There was no official flood warning system in place at the time of the December 2010 flood although Council staff phoned upstream properties to obtain updates on observed river levels higher up in the catchment.

3.4 Wandoan

Wandoan was largely spared from any direct flood damage during summer 2010 / 2011 flooding to property but suffered the secondary effects of isolation with the main Leichhardt Highway being cut both north and south of the town preventing travel to Taroom and Miles respectively. Once floodwaters receded a complete section of the highway north of Wandoan was revealed as being washed away.

Figure 3-7 Flood Damage to Leichhardt Highway North of Wandoan

3.5 Tara

Heavy rainfall was recorded across the catchment on the 26 and 27 December 2010. This can be seen in Figure 3-8 for two gauges. The gauge referenced as 'Tara Shire Council' is located within Tara and the gauge at The Ranch is located just outside the upper reaches of the catchment. Gauge locations are shown in Figure 3-9.

There are no automated river gauges in the catchment but observations by locals noted that flood waters rose quickly on Undulla Creek on December 27, 2010 with local estimates of two inches (five centimetres) every 10 minutes. The creek peaked at 0.8m on the 27 December.

Council's records indicate that 11 houses experienced flooding, mainly properties in the north of the town. The main issue was one of isolation with connecting roads remaining cut for between 7 and 10 days. 40 properties in the region were impacted in total.

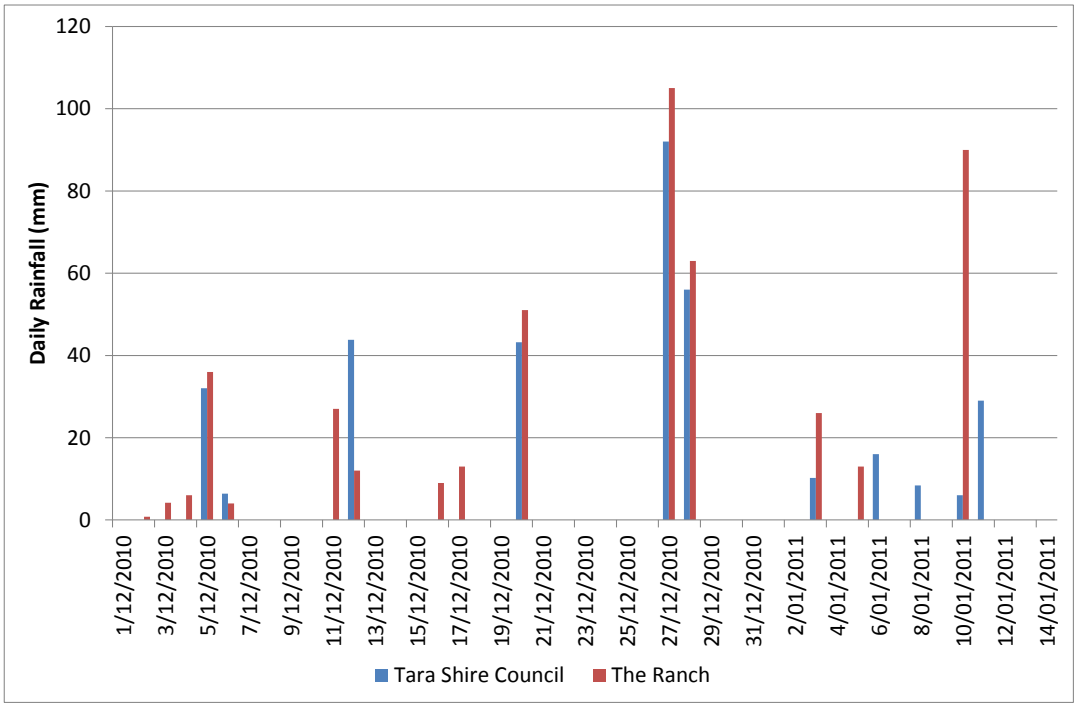

Figure 3-8 Tara – Recorded Rainfall Over the Undulla Creek Catchment

Figure 3-9 Selected Daily Rainfall Gauges – Undulla Creek Catchment

3.6 Jandowae

Heavy rainfall was recorded across the Jandowae Creek catchment on the 26/27 December 2010 and again on 9/10 January 2011. Figure 3-10 plots daily rainfall totals at selected gauges across the catchment and gauge locations are shown in Figure 3-11. It can be seen that there was also significant rainfall around 4/5 December. It is not known if this resulted in any flooding.

In Jandowae 27 properties were recorded as being flooded across the two events.

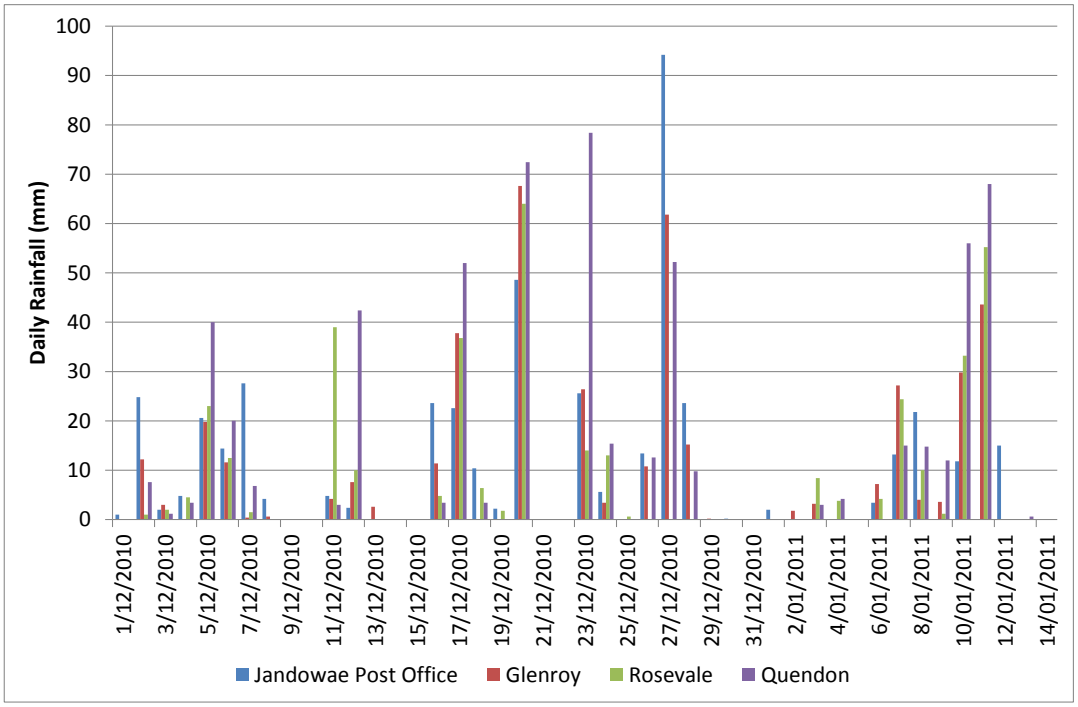

Figure 3-10 Jandowae – Recorded Rainfall Over the Jandowae Creek Catchment

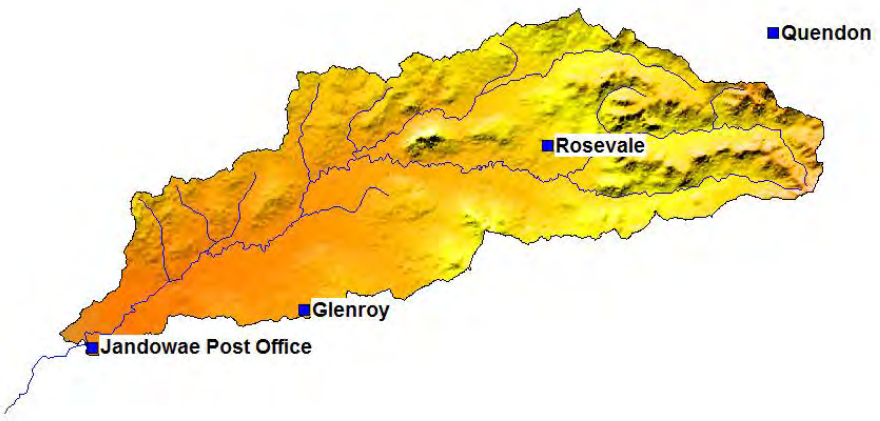

Figure 3-11 Jandowae Selected Daily Rainfall Gauges

3.7 Condamine

A double peaked hydrograph was tracked along the Condamine River system and fed by inflows from major tributaries. A hydrograph of water levels is shown in Figure 3-12 in which the two peaks can clearly be distinguished. The double peak led to the town of Condamine being affected by two flood events.

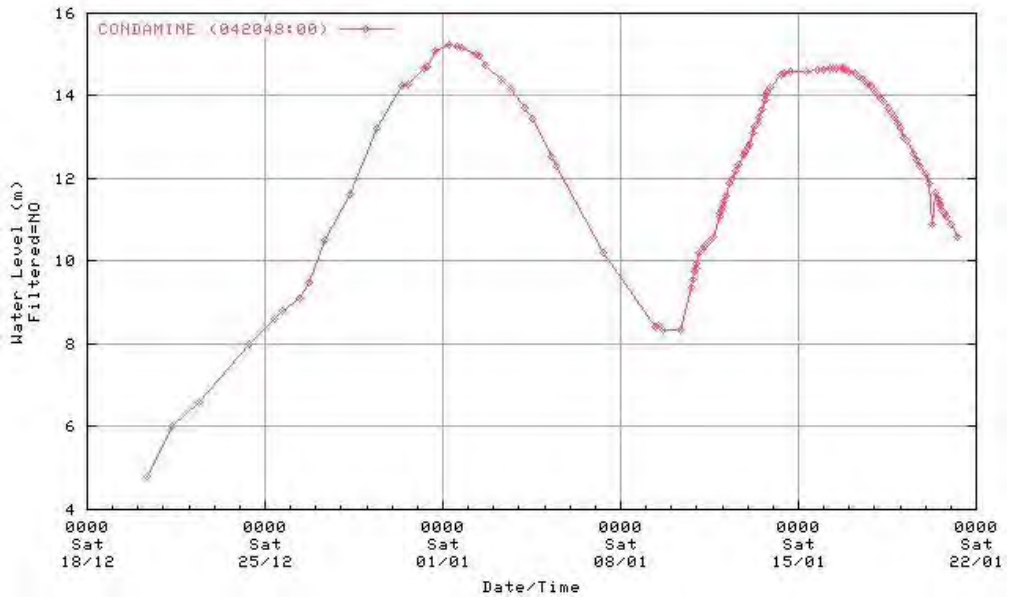

Figure 3-12 Flood Peaks on the Condamine River at Condamine (Dec 2010 – Jan 2010)

The first peak occurred on 1 January 2011 resulted in the first mandatory evacuation of Condamine on record, with residents evacuated to Dalby on 30 December 2010 by helicopter before the flood waters from the Condamine River encircled the town. The peak flood height recorded on 1 January was 15.25m measured at the Condamine gauge which represents the highest recorded level ever, surpassing the flood of 1942. It resulted in the inundation of 42 homes and 12 businesses. Evacuated residents began returning to Condamine on 5 January 2011 as flood levels receded.

The second flood event occurred on 16 January 2011. The Condamine River rose to 14.67m, the second highest recorded level ever, resulting in 12 homes and seven businesses being flooded. Residents were evacuated for a second time as a result of this flood event. Every road in Condamine was cut by floodwater. The flooding caused the water treatment plant to be shut down and it wasn't until the end of February 2011 that water restrictions were eased for the residents.

3.8 Warra

Two events are noted for Warra in the December 2010 and January 2011 floods. Jandowae Creek forms a significant tributary of Cooranga Creek and the same rainfall which affected Jandowae will have also impacted on Warra.

The first flood event occurred on the 28 December and an aerial image of this event through Warra is shown in Figure 3-13. It can be seen that a significant portion of the town was inundated.

Image courtesy of ABC (http://www.abc.net.au/local/stories/2010/12/28/3102835.htm)

Figure 3-13 Flooding in Warra looking Upstream (north), December 2010

4 EXISTING INFORMATION

4.1 Flood Warning Networks

As a general rule the larger the catchment, the greater the potential for a implementing a successful flood warning scheme. Flood warning schemes are typically joint ventures between Council and the Bureau of Meteorology although some of the gauges may be owned by the Department of Environment and Resource Management (DERM). Existing flood warning schemes within Councils area are summarised below.

Condamine River (Condamine and various)

The Condamine River is the most significant river in terms of size within Councils area. When it flood it can directly affect the town of Condamine but also has the potential to cause flow to back up smaller creeks and therefore influence the flooding in towns like Dalby and Chinchilla and Warra. It can affect numerous isolated rural homesteads and also results in significant inundation of agricultural land located within its fertile floodplain.

A flood warning network exists for the Condamine River between Warwick and Cotswold which includes the length of the Condamine through Councils area. The network benefits from a number of telemetry river stations along the length of river which can monitor the progress of a flood as it flows downstream. It is noted however that heavy rainfall over any of its significant tributaries can in turn cause the Condamine to flood.

Figure 2-2 shows the location of selected flood level gauges on the Condamine.

Charley's Creek (Chinchilla)

Charleys Creek flows by the town of Chinchilla before joining the Condamine 12km downstream. Charleys Creek is included as part of the Condamine 'Warwick to Cotswold' flood warning network although for the purposes of this report it has been treated separately. A flood level gauge exists on Charleys Creek at Chinchilla with a further telemetry flood gauge at Severn Oaks. Manual river stations also exist at Barncloth Bridge and Berna. Rainfall gauges are located in the upper catchment.

Myall Creek (Dalby)

A flood warning network exists for Myall Creek which has the ability to impact upon Dalby. A flood gauge at Patrick Street in Dalby is used for reporting levels within the town and there are two upstream flood level gauges at Moffatt and Clydesdale. Raingauges higher up in the catchment also provided automated responses for every millimetre of rainfall received.

Other Localities

It is understood that no official flood warning system exists for the regional towns of Miles (Dogwood Creek), Jandowae (Jandowae Creek), Tara (Undulla Creek) and Wandowae (Juandoh Creek). Potential exists for a flood warning network at Miles due to the relatively large upstream catchment. For the other localities any lead in time is likely to be short but may still be beneficial.

It is understood that Council has received funding for two new gauges within the region.

4.2 Data Collected following the 2010/2011 Floods

A significant volume of information has been collected by Council from various following the summer floods of 2010/2011. Table 4-1 to 4-8 summarise the key information collected.

The LDMG situation reports, WDRC media releases and flood damages reports have been sorted through a key information relating to flooding has been compiled into a searchable database.

Table 4-1 Flood Information Dalby

Type	Format
Map of flood affected properties (Event 1)	pdf
Map of flood affected properties (Event 2)	pdf
Map of flood affected properties (Event 3)	pdf
Ground truthing of flood marks in Dalby (Downes Survey Group)	Xls and pdf map
Aerial photos of flooding 28 December 2010	jpg
Photos of flooding taken on 27 December 2010 and 11 January 2011	jpg
Photos of flooding taken on 20 and 21 December 2010	jpg
Photos of flooded water treatment plant	jpg
Photos of road damage following flooding	jpg
Flood affected properties (93 entries)	xls

Table 4-2 Flood Information Chinchilla

Type	Format
Flood affected properties (264 entries)	xls
Map identifying inundated properties	pdf
Photos of flooding taken on 23, 27, 29 and 31 December 2010	jpg
Photos of flooding in July 2010	jpg

Table 4-3 Flood Information Miles

Type	Format
Photos of flooding 2010	jpg
Flood affected properties (5 entries)	xls

Table 4-4 Flood Information Jandowae

Ground truthing of flood marks in Jandowae (Downes Survey Group)	Xls and pdf map

Table 4-5 Flood Information Condamine

Type	Format
Map of flood affected properties	pdf
Photos of flooding taken on 31 December 2010	jpg
Aerial flood imagery 15/1/2011	pdf
Flood affected properties (43 entries)	xls

Table 4-6 Flood Information Tara

Type	Format
Flood affected properties (inundation/isolation/rescues) (38 entries)	Xls

Table 4-7 Flood Information Warra

Type	Format
Ground truthing of flood marks in Jandowae (Downes Survey Group)	Xls and pdf map

Table 4-8 Flood Information Various

Type	Format
BOM Water level plots	jpg
LDMG Situation Reports	doc
Media Releases	doc
Details of rural properties inundated	doc

4.3 Previous Studies

4.3.1 Myall Creek Flood Study, Dalby (2007)

This study assessed areas at risk of flood inundation in Dalby both from Myall Creek and Spring Creek. It also assessed the risk from the Condamine River although it was determined that in general this did not influence flood levels within the town.

The study used hydrological and hydraulic modelling to model a range of design flood events which included the 2, 5, 10, 20, 50, 100 and 500 year ARI events. The Probable Maximum Flood was also modelled. For each event design depths, velocities and flood hazard values were derived for Dalby. This study was used to derive the design flood planning level for planning purposes within Dalby. The study analysed the largest historical flood on record which occurred in 1981 (recording a level of 4.5m at the Patrick Street Gauge) and concluded that this represented a 350 year ARI event.

4.3.2 Planning Scheme Review: Flooding and Stormwater (2011)

Water Technology were commissioned by Council to review planning schemes for Dalby and five regional centres (Chinchilla, Miles, Wandoan, Tara and Jandowae) with the aim of applying a consistent approach with regards to flood planning policy in the development of a single planning scheme for the Council area.

The purpose of the study was to define and map the risk to the towns from both stormwater and riverine flooding.

Hydrological and hydraulic modelling was used to determine flood extents, depths and levels for a range of design flood events up to and including the 1% AEP (100 year ARI) event. The study also considered additional flows due to climate change whereby rainfall was increased by 5% and 20%. It is understood that additional model runs are currently being undertaken to include higher order design flood events including the Probable Maximum Flood (PMF).

The study recognises the considerable uncertainty in the hydrological estimates due to limited historical data for calibration purposes.

LiDAR data was flown in 2010 by WDRC to assist with the studies for the 6 towns. This is a key dataset and will be of high importance for any future flood investigations within the towns.

The study also considered historical floods and used the hydrological modelling to attempt to put a frequency estimate on historical floods.

The study notes that the 100 year ARI flood event inclusive of 5% climate change allowance was adopted as the Defined Flood Event. Previously in Chinchilla and Condamine this event was defined as the 1942 flood level plus 300mm freeboard. It is also understood that Water Technology has been commissioned to update the existing hydraulic model in Dalby.

5 RECOMMENDATIONS

The following recommendations are made based on our knowledge of the study area and data currently available.

- Due to the history and extent of flooding along with the number of properties inundated a full flood management study is recommended for the following towns:
  - Dalby;
  - Chinchilla; and
  - Jandowae.
- Modelling should also be considered to clarify the flood risk for the following locations:
  - Warra;
  - Condamine; and
  - Meandarra.
- The remaining towns of Miles, Wandoan and Tara have historically only incurred flooding in terms of number of properties affected. In these localities the issues of isolation are of greater concern. It is recommended that these localities do not undergo a full risk management study but instead focus on components such as flood emergency planning measures and community awareness.

If further modelling is to be undertaken for Warra, Condamine and Meandarra then it is recommended that LiDAR data is obtained. This will assist with modelling and also flood planning/zoning within the towns.

- It is recommended to obtain property floor level information for the following locations for houses within the mapped 100 year ARI flood extent:
  - Dalby;
  - Chinchilla;
  - Jandowae;
  - Warra (if supporting modelling is undertaken);
  - Condamine (if supporting modelling is undertaken); and
  - Meandarra (if supporting modelling is undertaken).
- The following additional information would assist the next stage of the study:
  - Information of planned future development within the localities studied will be beneficial. This includes planning infrastructure or works associated with natural resources.
  - Whilst not essential to the study it would be beneficial to have a copy of SKM's 2005 report on the Lower Condamine.
  - Information on all current and planned BOM/Council flood Alert systems including gauge locations. For example we understand that gauges have recently been installed near

Mandarra at Bringalow Creek and the Surat Developmental Road crossing of Horse Creek (10km west of The Gums).

- A copy of the Dalby update study being undertaken by Water Technology.
- Copies of all digital modelled output data from the Water Technologies modelling study. This should include peak water level grids for the various design ARI events for use in cost benefit assessments.
- Any consultation on the DFE if it was adopted from the 2011 studies.

6 REFERENCES

CSC, 2003 - Chinchilla Shire Council, Disaster Risk Management Report Part A, Department of Transport and Regional Services

FH & T ,2011, - Flood: Horror and Tragedy, Agnew P & F Association Inc

MSC, 2002 - Murilla Shire Council, Disaster Risk Management Report Part A, Department of Transport and Regional Services

QFCIIR, 2011 - Queensland Floods Commission Interim Report – need proper reference

SKM (2007), Myall Creek Flood Study, Dalby. Report prepared by SKM for Dalby Town Council, June 2007.

TSC, 2002 - Tara Shire Council, Disaster Risk Management Report Part A, Department of Transport and Regional Services

WDRC, 2011, - Queensland Floods Commission of Inquiry Western Downs Regional Council Statement

WSC, 2002 - Wambo Shire Council, Natural Disaster Risk Management Report

WT, 2011 - Western Downs Regional Council, Planning Scheme Review: Flooding and Stormwater Chinchilla, Miles, Wandoan, Tara and Jandowae, Water Technology

BMT WBM Brisbane
Level 8, 200 Creek Street Brisbane 4000
PO Box 203 Spring Hill QLD 4004
Tel +61 7 3831 6744 Fax +61 7 3832 3627
Email bmtwbm@bmtwbm.com.au
Web www.bmtwbm.com.au

BMT WBM Denver
8200 S. Akron Street, Unit 120
Centennial Denver Colorado 80112 USA
Tel +1 303 792 9814 Fax +1 303 792 9742
Email denver@bmtwbm.com
Web www.bmtwbm.com.au

BMT WBM Mackay
Suite 1, 138 Wood Street Mackay 4740
PO Box 4447 Mackay QLD 4740
Tel +61 7 4953 5144 Fax +61 7 4953 5132
Email mackay@bmtwbm.com.au
Web www.bmtwbm.com.au

BMT WBM Melbourne
Level 5, 99 King Street Melbourne 3000
PO Box 604 Collins Street West VIC 8007
Tel +61 3 8620 6100 Fax +61 3 8620 6105
Email melbourne@bmtwbm.com.au
Web www.bmtwbm.com.au

BMT WBM Newcastle
126 Belford Street Broadmeadow 2292
PO Box 266 Broadmeadow NSW 2292
Tel +61 2 4940 8882 Fax +61 2 4940 8887
Email newcastle@bmtwbm.com.au
Web www.bmtwbm.com.au

BMT WBM Perth
Suite 6, 29 Hood Street Subiaco 6008
Tel +61 8 9328 2029 Fax +61 8 9484 7588
Email perth@bmtwbm.com.au
Web www.bmtwbm.com.au

BMT WBM Sydney
Level 1, 256-258 Norton Street Leichhardt 2040
PO Box 194 Leichhardt NSW 2040
Tel +61 2 9713 4836 Fax +61 2 9713 4890
Email sydney@bmtwbm.com.au
Web www.bmtwbm.com.au

BMT WBM Vancouver
401 611 Alexander Street Vancouver
British Columbia V6A 1E1 Canada
Tel +1 604 683 5777 Fax +1 604 608 3232
Email vancouver@bmtwbm.com
Web www.bmtwbm.com.au