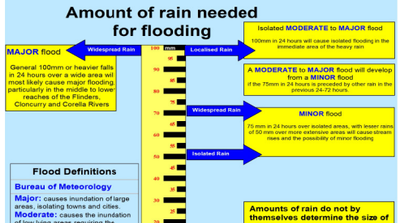
Flinders River Catchment Flood Rules of Thumb

How is this wall chart meant to be used?
This wall chart provides a catchment-wide overview of flooding patterns and the factors that influence the size, behaviour and impact of a flood. This chart is designed to be studied in detail. Information has been combined from local knowledge, historical records, available data, scientific articles, engineering equations and available mapping.

Amount of rain needed for flooding



Flood Definitions

Bureau of Meteorology

Major: causes inundation of large areas, isolating towns and cities.

Moderate: causes the inundation of low lying areas requiring the removal of stock and/or the evacuation of some houses.

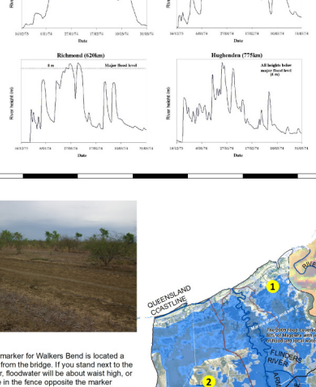
Minor: causes inconvenience such as closing of minor roads and the submergence of low level bridges.

Local flooding is an annual event north of the Canobie-Saxby constriction once the wet season rains begin. The rains generally fall in these mid down-stream sections of the catchment before the upper catchment. Fifty to 75mm of rain spread across Canobie, Warren Vale and Normanton produces minor to moderate localised flooding. Such local flooding is part of the regular wet season and is generally beneficial as the native pastures respond as the waters recede. The flood water usually drains slowly across the flat floodplains and away through the River or Creek channels over a couple of weeks. There can be a second flood peak as the waters from upstream (Hughenden, Richmond, Julia Creek or Cloncurry) rains arrive.

Major localised flooding north of the Canobie-Saxby constriction can occur during periods of extended local rainfall in excess of 100mm. These floods last longer as local rains continue or as water arrives from upstream faster then it can drain away. Major localised flooding north of the Bang Bang-Glenore constriction may be influenced by king tides in the gulf, potentially stopping water from draining away for short periods of time.

Major widespread flooding can develop when fresh floodwaters from upstream back up behind floodwater at the Canobie-Saxby constriction. The risk is especially high when there is general rain or high rainfall totals in the harder country, which keep floodwaters flowing in from upstream. Major floods—especially when the peak stays up for more than three weeks—pose a serious threat to pastures, soils, cattle and infrastructure. The floods in early 2009 stayed up over the major flood level for six weeks and caused extensive damage and stock losses.

It's not the same flood all along the river. As flood water moves down the Flinders it joins flows from other tributaries and moves into climatically wetter catchments. This results in more gradual changes in water level but potentially longer periods of inundation during floods along the lower reaches. The graphs (right) show this by comparing flood levels at four locations during the 1974 flood—the further a location is from the river mouth (in brackets) the more flood levels fluctuate.



Why is flooding important in the Flinders River catchment?
Livestock losses and damage to fences, roads and structures can be severe along the floodplains of the Gulf Rivers. Some properties have enough high ground to shift stock onto at the start of every wet season. Other properties have enough high ground for stock to take refuge during a normal wet season or minor floods but not a major flood. Predicting a major flood is difficult and predicting such floods with enough time for landholders to move stock to safety is especially difficult. The greatest flood risk tends to be downstream (north) of the Canobie-Saxby restriction, where there is inadequate high ground in a major flood. Other important areas can be seen on this map, such as the Corella River floodplains north-west of Kalmeta homestead.

Reducing flood risk cf livestock losses
Experienced producers and helicopter pilots have offered the following advice to recuce the risk of stock loss to floods.

If you are new to the area, seek advice from experienced locals to judge how much country can flood, how deep it can flood, where the floodwaters flow and where the high ground is.

Provide stock with access to high ground for the wet season. Many producers move their stock into the paddocks with the highest ground ready for every wet season. This provides access to the high ground during a flood and reduces the need to try and muster stock through floodwaters. It also rests the pastures in the flood-prone areas for the wet season and maintains their health. Some properties have no country above major flood height. Consider increasing the height of existing elevated areas and widening the bank of dams and turkey nests.

Maximise your access to stock for the wet season. There are situations where on-ground access will be impossible once the creeks and rivers start to flow. Move livestock to accessible areas before the only option left is more expensive aerial mustering. 'Murphy's Law' suggests that a helicopter will not be available when urgently needed.

Develop flood management plans based on all the available information including; your own property infrastructure plan, your knowledge of how much country can flood, how deep it can flood, where the floodwaters flow and where the high ground is. Consider how existing or planned turkey's nests and other high structures can be used as livestock flood refuges. Use the latest technology such as satellite images of previous floods and Global Positioning Systems to mark the high ground.

Plan your forage availability. There will be occasions e.g. following drought, that there is insufficient pasture on high country to support large numbers cf cattle for more than a few cays—or even hours. Conduct a forage budget for the high country and estimate how many livestock each area can support and for how long. Consider how fodder could be delivered to—or perhaps stored on—high ground during a flood. Incorporate this into your flood management plans.

Plan your fencing to reduce the number of cattle trapped in corners or along fence-lines during floods. Cattle can be trappec by fences when they are travelling to high ground or when they are swimming downstream. Suggestions to reduce this risk include installing gateways every 1-2km to allow cattle to move to safety prior to and during floods; open gates prior to the wet season to provide access to high ground; build gates that allow for easy opening from a helicopter e.g. platforms to sit the chopper skids on during floods; rectify fence-lines and corners with a high risk of trapping cattle e.g. a boundary corner on the wrong side of high ground.

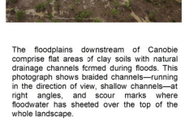
Livestock type and class. Larger cattle have a better chance of surviving a flood. Consider if the timing of calving maximises calf/weaner size by the wet season. Water of a depth greater than 1-1.5m will prevent calves from suckling their mothers. If water stays at these depths for more than a couple of days, calf losses will be high.

Cattle condition. Be aware that cattle in poor condition going into the wet season wil be at greater risk of exposure and fatigue should temperatures drop and cattle have to swim or walk through heavy mud.

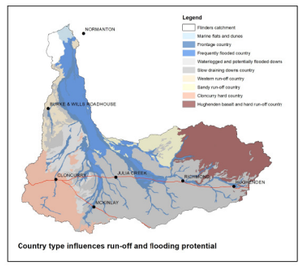
During a flood regular information is the key to estimating how deep the water might become and how far it might flood out. Track the progress of a flood by communicating with people on the river upstream, through the Bureau of Meteorology flood and rainfall web site, ABC Radio and other available sources.

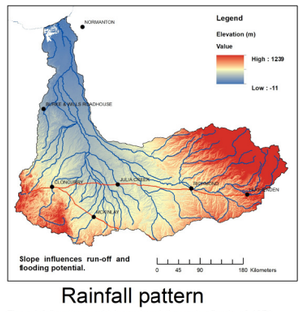
During a flood muster cautiously. Cattle will tend to know where the high ground is. Often it is best to leave them alone to find the high ground rather than trying to push them through floodwaters or across main channels.

Main factors affecting flooding in the Flinders River catchment
- The major flood prone area is downstream from about Canobie.
- Flood prone areas exist further upstream to about Consentes.
- The major flood prone area also receives high rainfall—local flooding rains occur most wet seasons but the water drains away before causing problems.
- Three major river systems—the Flinders, Cloncurry and Saxby—all join within the major flood prone area. When all three of the rivers are flowing through the flood prone area, local floodwaters from rainfall drain away slowly.
- The Flinders River headwaters are in a large area of hard and steep run-off country with relatively higher rainfall. It flows every year and has the highest chance of flooding.
- The Cloncurry River headwaters are in hard and steep country, but rainfall is relatively low and variable—this makes flooding difficult to predict. A reasonably large catchment ensures flows in most years but these may not always reach the Flinders River.
- The Saxby River headwaters are in sandy and relatively flat country with intermediate rainfall and a smaller catchment than the other Rivers—it is likely to flow regularly but for less time than the Flinders River.
- Widespread above average rains lead to major floods—all three rivers flood preventing local floodwaters from draining away from the flood prone areas. The water becomes deeper the longer it keeps raining.
- Records suggest the probability of widespread above average rainfall is greatest when the SOI is consistently positive in September-October.



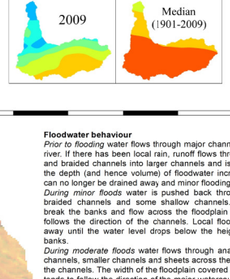
The floodplains downstream of Canobie comprise flat areas of clay soils with natural drainage channels formed during floods. This photograph shows braided channels—running in the direction of view, shallow channels—at right angles, and scour marks where floodwater has sheeted over the top of the whole landscape.





Rainfall pattern

The rainfall patterns which produced the major floods of 1974, 1991 and 2009 were all different—one indicator of how difficult it is to predict which rivers will run first and where the majority of the floodwater will come from.



Slope and type of country

Slope and country type have a major bearing on how much rain it takes for water to start running into streams—and how fast it runs.

The steepest area in the Flinders River catchment is to the east, with the Great Dividing Range forming the eastern watershed. The Flinders River starts at an elevation of 825m and drops down to 320m at Hughenden over a distance of 100km. Steep slopes lead to fast run-off, fast stream flows and natural erosion. Porcupine Gorge to the north of Hughenden provides one example of how much erosion has been caused from high volumes of fast flowing water coming out of this area. The area south-west of Cloncurry also has steep slopes and gorges, and the western margin of the catchment has slopes which can result in localised flash-flooding. The slopes of these run-off areas are in contrast with the last 280km of the Flinders, with a fall of only 100m. Instead of eroding, much of this flooded area generally receives a top-dressing of silt from upstream.

There are 14 main Grazing Land Management Land Types within the Flinders River catchment (https://futurebeef.com.au/knowledge-centre/). In terms of their role in flooding these can be broadly grouped into run-off and flooded country.

Hughenden basalt and hard run-off country covers an area of 19,000km^2 to the north and east of Hughenden and is dominated by red and black basalt, sandy forest, ironbark and rough spinifex hills at high elevations. The harder country only needs about 50mm of rain on a dry catchment to start streams flowing, whilst the basalt may be a recharge area for underground aquifers. Coupled with a relatively high average rainfall and steep slopes, the area is a regular contributor to Flinders River flows.

Cloncurry hard run-off country covers an area of 14,000km^2 to the south-west of Cloncurry and is dominated by rough spinifex hills. This country only needs about 25mm of rain to start streams flowing on a dry catchment. It receives generally low and variable rainfall which makes it difficult to predict when the Cloncurry River will flood.

The western run-off country covers 8,000km^2 along the western margin of the catchment and is dominated by silver-leaved box with spinifex, open red country and rough spinifex hills. This area needs 25-50mm of rain to start streams flowing on a dry catchment. It mostly contributes to localised flooding downstream of Canobie due to its location and average annual rainfall of 400-600mm.

The sandy run-off country covers 5,000km^2 to the north-west of Richmond and is dominated by sandy forest and silver-leaved box. It forms a low water-shed dividing the Saxby and Norman Rivers. This area may start running water with 50mm of rain, but the drainage lines are often indistinct with water pooling locally. These soils can become very boggy when wet.

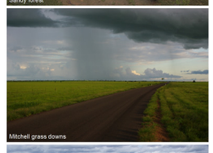
Slow draining downs country covers 40,000km^2 along the southern portion of the catchment. There is a further 7,000km^2 adjacent to the Cloncurry, Dugald and Corella Rivers on the western side of the catchment. The downs are dominated by Mitchell grass and include locally important areas of gidgee. The downs country consists of heavy clay soils with little slope which generally need 100-150mm of rain to start running water when dry. Once fully saturated these soils will run with as little as 10mm of rain. Downs country can contribute substantial amounts of water in above average rainfall years.

The flooded country covers 12,500km^2 and starts near Sedan Dip where the Gilliat Channels and Cloncurry Rivers join. The extensive floodplains start around Canobie where the Corella and Cloncurry Rivers join, and the Flinders is close enough for the floodwaters of both systems to mix. The broad floodplains are dominated by bluegrass browntop plains with major channels fringed by frontage country. There are areas of Mitchell grass—often on slightly higher ground—within the floodplains which can also flood but for a shorter duration. Flooding occurs along all major drainage lines, being confined to frontage country in the upper reaches but breaking out into floodplains in flatter areas. Mitchell grass country to the south also floods during major events. Marine flats along the northern margin are seasonally flooded.

Basalt country

Rough spinifex hills

Sandy forest


Mitchell grass downs

Bluegrass browntop plains in flood

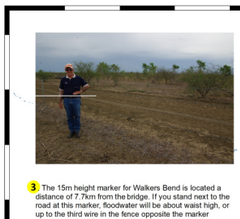
Frontage country

Examples of major floods

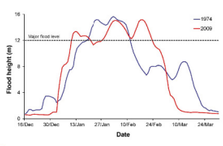
River height station	1974 Jan/Feb	1981 January	1984 January	1991 January	1991 February	2009 January	2009 February
Mt Emu Plains	4.00	**4.79****	3.21	4.55	3.41	-	-
Glendower	5.34	5.54	4.37	4.42	**7.00**	3.32	-
Hughenden	2.05	2.6	2.1	2.4	3.3	2.80	**2.90**
Marathon	-	10.8	**11.6**	9.5	10.3	-	-
Richmond	**8.47**	7.8	8.4	7.4	7.5	8.13	8.21
Hulberts Bridge	**12.5**	12.05	12.6	12.0	11.3	-	-
Etta Plains	**11.30**	10.72	10.94	-	-	10.67	10.05
Julia Creek	**5.43**	-	3.16	4.82	3.85	3.98	-
Landsborough Highway Cloncurry*	-	-	-	-	-	6.33	**6.41**
Carsland	7.26	5.7	4.8	7.8	4.85	**8.03**	7.79
Dugald River	-	**6.0**	-	5.2	3.72	-	-
Canobie	5.67	4.15	3.16	-	-	**6.08**	4.61
Walkers Bend*	**15.67**	12.74	11.95	15.23	11.37	13.36	15.06

* automated station ** bold indicates highest flood on record

The table (above) shows heights for some of the major floods from recording stations within the Flinders catchment. This table provides a useful reference point for anticipating the depth of water—and how far cut it may flood—for these locations.



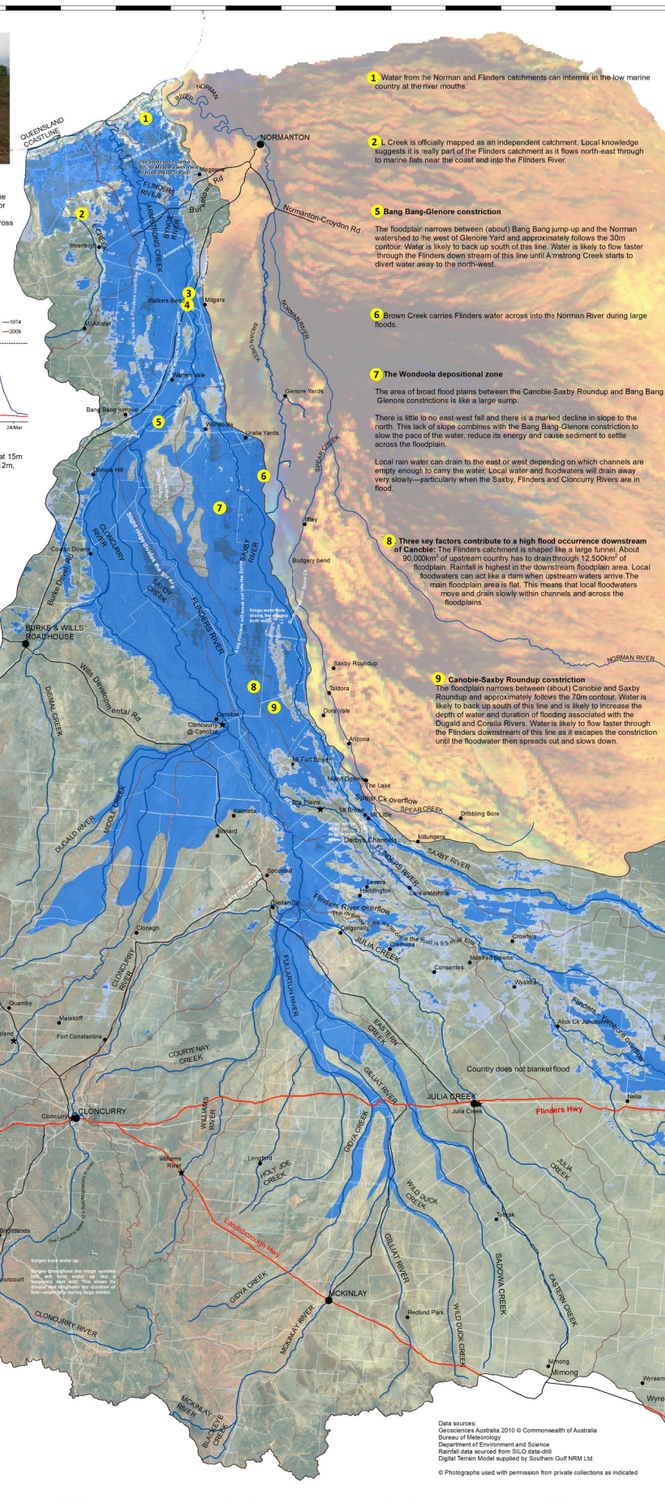
3 The 15m height marker for Walkers Bend is located a distance of 7.7km from the bridge. If you stand next to the road at this marker, floodwater will be about waist high, or up to the third wire in the fence opposite the marker (see photo above). The floodwater will be spread out across the floodplains and also areas that don't usually flood at this level.



4 The largest recorded floods at Walkers Bend peaked at 15m in 1974 and 2009 (see graph). The major flood level is 12m, which is about 2m over the bridge.

When the upper catchment is bare, floods will develop faster and potentially be larger and so carry more sediment. When the upper catchment has good ground cover, run-off and erosion are reduced.

Water colour The Cloncurry River near Brightlands, showing its red colour as a result of draining out of the red spinifex soils and hills. The colour is in contrast with the milky grey waters of the Flinders and Saxby which drain mainly Mitchell grass downs


QUEENSLAND
NORTHERN TERRITORY
NORMANTON
Burke & Wills Roadhouse
Glenore Yards
Bang Bang Yards
Unata Yards
Gilliat
Cloncurry
Julia Creek
Richmond
Hughenden
Kalkadoon
Dugald
Corella
Saxby
Flinders
Norman
Country does not blanket flood
Flinders Hwy
Landsborough Hwy
Kennedy Hwy
Gulf Developmental Rd
Normanton-Croydon Rd
Burke Developmental Rd
Cloncurry Dajarra Rd
Cloncurry Ballara Rd
Cloncurry Mt Isa Rd
Julia Creek Richmond Rd
Hughenden Muttaburra Rd
Hughenden Charters Towers Rd
Hughenden Winton Rd
Hughenden Cloncurry Rd
Richmond Maxwelton Rd
Richmond Kynuna Rd
Richmond Corfield Rd
Richmond Hughenden Rd
Richmond Julia Creek Rd
Richmond Torrens Creek Rd
Richmond Charters Towers Rd
Richmond Winton Rd
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Richmond Dajarra Rd
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