

Kialla to Loch Garry

At a glance

The flow footprints constraints work is investigating are 25–40,000 megalitres/day (ML/d) between Kialla and Loch Garry (e.g. 9.4–10.3 m at Shepparton, gauging station 405204, around the minor flood level). Flow footprints higher than 40,000 ML/d are not being investigated (e.g. flows greater than 10.3 m at Shepparton gauging station 405204). The overbank flows that constraints work is looking at occurred more frequently in the past.

Feedback from local councils and landholders was that the flow footprint maps looked about right, although they probably overestimate the Shepparton flow footprint at 40,000ML/d.

Initial feedback from landholders suggests that flow footprints up to 30,000 ML/d at Shepparton (9.8 m) may be a tolerable level of inconvenience flooding. This is subject to suitable mitigation measures being in place (e.g. improved roads and drainage, reliable level of rural levee protection). The flow footprint of flows between 25,000 and 30,000 ML/d, around minor flood level, could be created by releases from Eildon and/or Goulburn Weir in combination with tributary flows.

Reach characteristics

This subreach flows from Kialla just below Shepparton to Loch Garry near Bunbartha (Figure 39). Mooroopna and Shepparton are located in this part of the Goulburn. Two unregulated tributaries contribute flows to the Goulburn River: the Broken River and Seven Creeks.

There are a number of regionally and nationally significant wetlands around Shepparton–Mooroopna and downstream (e.g. Reedy Swamp Wildlife Reserve, Gemmills Swamp, Mooroopna Common and Loch Garry).

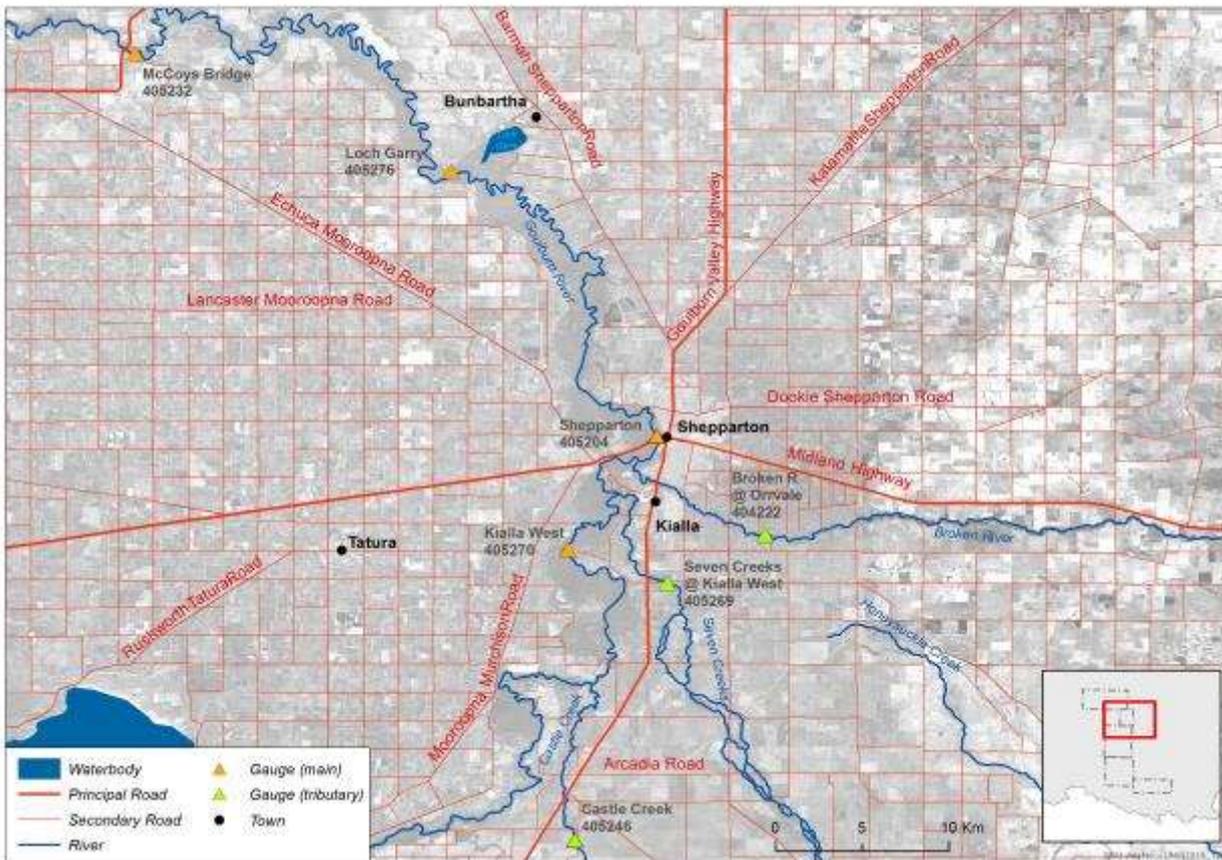
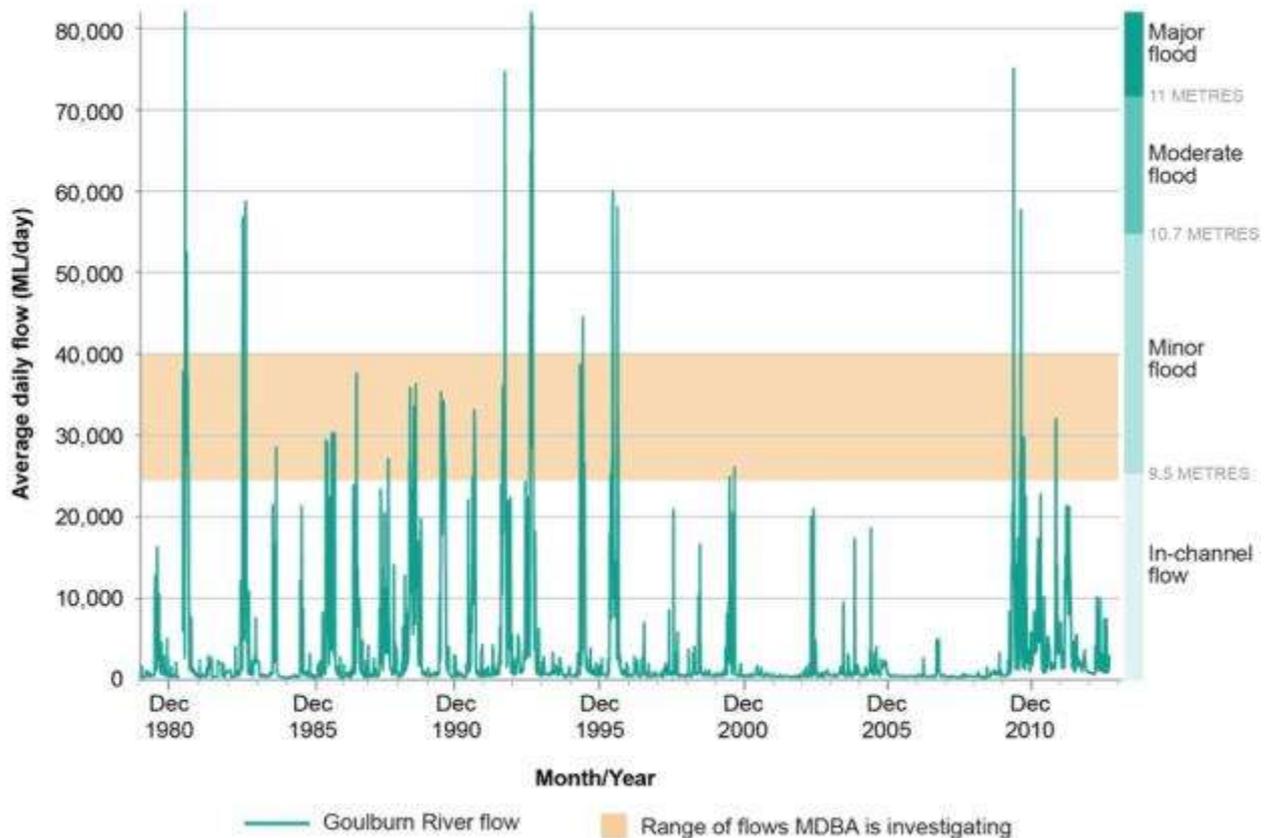


Figure 39 Kialla to Loch Garry subreach

There is one flood gauge situated on the Goulburn River in this subreach (at Shepparton) that is used by the Bureau of Meteorology for flood forecasting purposes. The river flows recorded at the Goulburn River gauge at Shepparton between 1979 and 2013 can be seen in Figure 40.



MDBA = Murray-Darling Basin Authority; ML = megalitre

Note: The shaded box outlines the range of flows that MDBA is investigating (25–40,000 ML/day).

The flood categories (minor, moderate and major floods) are as defined by the Bureau of Meteorology, noting that flood categories are linked to specific gauges. As you move away from the gauge, the river situation can be quite different from what is being recorded at the gauge.

Figure 40 Flows in the Goulburn River at Shepparton gauge, 1979–2013

Since the completion of Big Eildon Dam in 1955, major flooding has occurred around the Shepparton–Mooroopna area in 1956, 1958, 1974, 1975, 1981, 1992, 1993 and 2010. These major floods have highlighted that the relative contribution from the Goulburn and Broken rivers, and Seven Creeks can vary significantly, and that the relative contribution from the three catchments can markedly influence flood behaviour in Shepparton–Mooroopna.

The 1974 flood was dominated by the Goulburn River and by the Broken River in 1993. The 2010 flood saw gauges on the Goulburn and Broken Rivers, and Seven Creeks all peak at major flood level.

Floods with different volumes of water behind them have very different behaviours — the 1974 flood took 18 hours to get from Shepparton to McCoy Bridge, whereas the

*1993 flood was much slower.
Resident near McCoy Bridge*

Historical data are presented in Table 12, together with other examples of moderate and minor flood events. A range of flows has been provided as background context for the river levels that people have experienced first-hand. Many are far larger and more damaging than the flows constraints work is investigating; they are not the aim of this Strategy. Some of the smaller historical events are also included in Table 12 that are in the range of the managed overbank flows being investigated. This is so people can think about the types of effects that have occurred at flows of these sizes.

Table 12 Example recorded flows for the Goulburn River at Shepparton (gauging station 405204)

Flood class	Date	Gauge height (m)	Flow (megalitres/day)	Is constraints work considering these sorts of flows?
Major	17 May 1974	12.08	191,166	No
Major	20 September 1975	11.21	89,632	No
Major	25 July 1981	11.19	87,200	No
Major	23 September 1993	11.18	86,140	No
Major	20 October 1992	11.13	82,433	No
Major	8 September 2010	11.09	78,550	No
Moderate	12 December 2010	10.80	59,617	No
Moderate	5 October 1996	10.77	57,807	No
Minor	6 March 2012	9.96	32,335	Yes
Minor	19 January 2011	9.81	30,097	Yes
Minor	15 November 2000	9.52	26,340	Yes

What flows are being considered

Constraints work is investigating flow rates of between 25,000 and 40,000 ML/d (e.g. 9.4–10.3 m at the Shepparton gauge, station 405204) (Table 13 and as indicated by the shaded box on Figure 40).

These would be overbank flows up to around the minor flood level range. At below minor flood level, river levels are not high enough to trigger emergency management or flood warnings from the Bureau of Meteorology. At minor flood level, there is some inconvenience. Low-lying areas next to rivers and creeks start to get wet, requiring the removal of stock and equipment. Minor roads may be closed and low-level bridges submerged (see also ‘What is the Constraints Management Strategy?’).

Constraints work is **not** considering flows at moderate or major flood levels. Flows significantly higher than the minor flood level are damaging and disruptive, and outside the bounds of active river management. Constraints work is collecting information about what effects river flows have at different places along the Goulburn River, but only up to the minor flood level range.

Table 13 Comparison of flows footprints for the Kialla to Loch Garry subreach and flood categories at the Shepparton gauge

Measure	Flow footprints being looked at for the Kialla to Loch Garry subreach (that include the flow contribution of tributaries)			Shepparton gauge, Minor flood level ¹	Shepparton gauge, Moderate flood level ¹	Shepparton gauge, Major flood level ¹
	25,000	30,000	40,000			
Flow rate (megalitres/day)	25,000	30,000	40,000	26,000	54,000	72,000
e.g. Gauge height (m) at Shepparton	9.4	9.8	10.3	9.5	10.7	11.0

¹ Bureau of Meteorology, noting that flood categories are linked to specific gauges. As you move away from the gauge, the river situation can be quite different from what is being recorded at the gauge.

The flows that constraints work is looking at have occurred in the past. The hydrographic record shows that flows around the minor flood level (staying inside the levees) have happened more than 15 times since 1979. They are therefore not an unusual type of flow. Outside of drought periods, people in the region are already managing through flow events of this size at least every few years.

*From my memory, there were only a couple of years where floodwaters did not come up to the levee on the floodplain (they were 1968 and 1982). Otherwise, up until 1997 floodwaters came up to the levee every year. Then from 1997 we hit approximately 12 years of drought and it stopped happening.
Long-term resident at Kotupna*

What these flows look like

Linking a gauge reading at Shepparton with the actual flow downstream is not always accurate, because of the effect of tributaries inflows and localised rainfall run-off. To assist MDBA to understand how landholders and community assets could be affected by different flows, flow footprint maps were developed to help visualise the flows.

Flow footprint maps were created using hydraulic models to show how flows of different sizes move down the river and spread across the landscape. Flow footprint maps let you look at what is likely to get wet for different-sized river flows.

When interpreting the maps, it is important to bear in mind that they are from a model of a generalised event, not a real event. Therefore, some caution should be used when interpreting the 'typical flow' footprints presented in this report. They are not intended to mimic real flow events, but be an initial representation of what could get wet for a flow of a particular size.

Figure 41 shows a flow footprint map for flows of 25,000, 30,000 and 40,000 ML/d between Kialla and Bunbartha (Loch Garry).

The map shows the wetlands and near-floodplain getting wet around Shepparton and downstream, but largely staying within the protective levee network. This land is mainly river reserves and national park.

Feedback from local councils and landholders was that the flow footprint maps looked about right, although the maps probably overestimate the Shepparton flow footprint at 40,000 ML/d. The maps show the lake near the CMA and Princess Park oval as being wet. However, even in September 2010, the football oval itself didn't connect with the river and that flow was much bigger (up near 90,000 ML/d). In general, the flow footprints look a little overstated.

The accuracy of the maps is currently limited by the amount of data available to calibrate the hydraulic model. The maps should therefore be viewed as a first estimate, with more accurate mapping required.

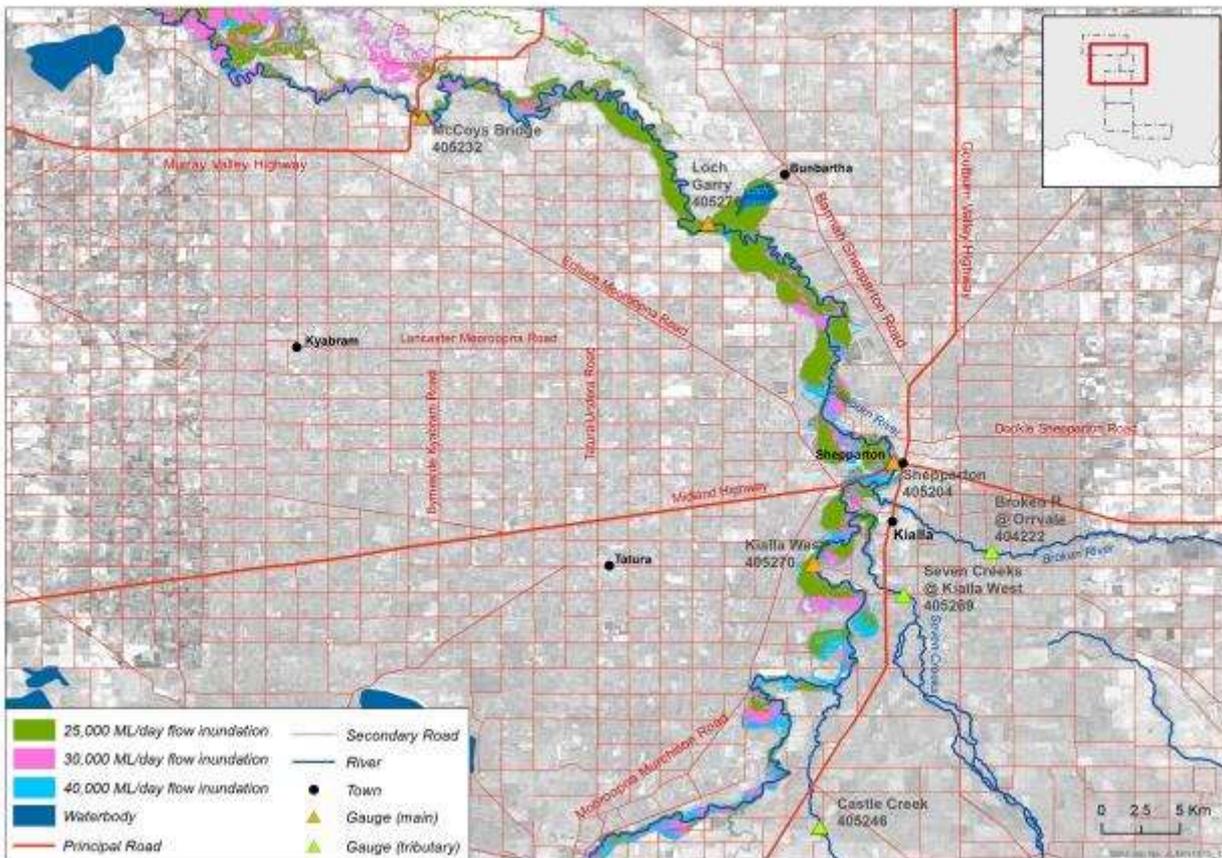


Figure 41 Flow footprints for flows of 25,000, 30,000 and 40,000 megalitres (ML)/day between Kialla and Loch Garry

Tributaries

The tributaries in the Goulburn have different characteristics and therefore different effects on the flow of the main Goulburn stem. Water Technology analysed historical flow data in the Goulburn River and its tributaries to provide a general, though incomplete, understanding of the tributaries in the Goulburn catchment. This information is summarised for each tributary below.

Seven Creeks

Seven Creeks has a catchment area of 1,505 km². The creek has one gauge at Kialla West. This gauge has 10 years of instantaneous data, classified as poor, with missing data during high flow periods (due to backwater effects from Goulburn River). The mean daily flow for July–November is 219 ML/d (Figure 42).. The 'peakiness' ratio value of the catchment is 4.90.

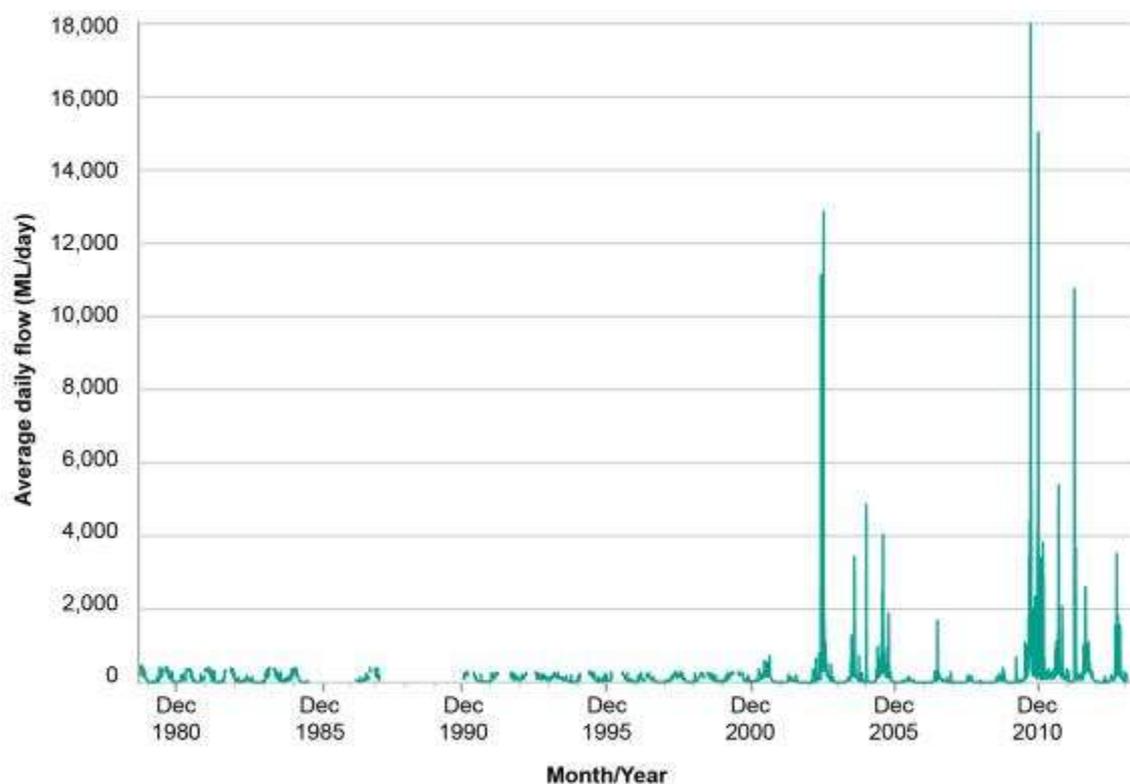


Figure 42 Average daily water flow in Seven Creeks Kialla West (gauging station 405269), December 1980 – December 2013

Broken River

The Broken has a catchment area of 2,508 km². The Broken has one gauge at Orrvale which has 25 years of instantaneous data, classified as 'good'. The mean daily flow for July–November is 362 ML/d. The 'peakiness' ratio value of the catchment is 28.32 (Figure 43). Historically flows were affected by large upstream diversions into Lake Mokoan and Broken Creek Systems — Lake Mokoan was decommissioned and returned to natural wetland system as of 2009.

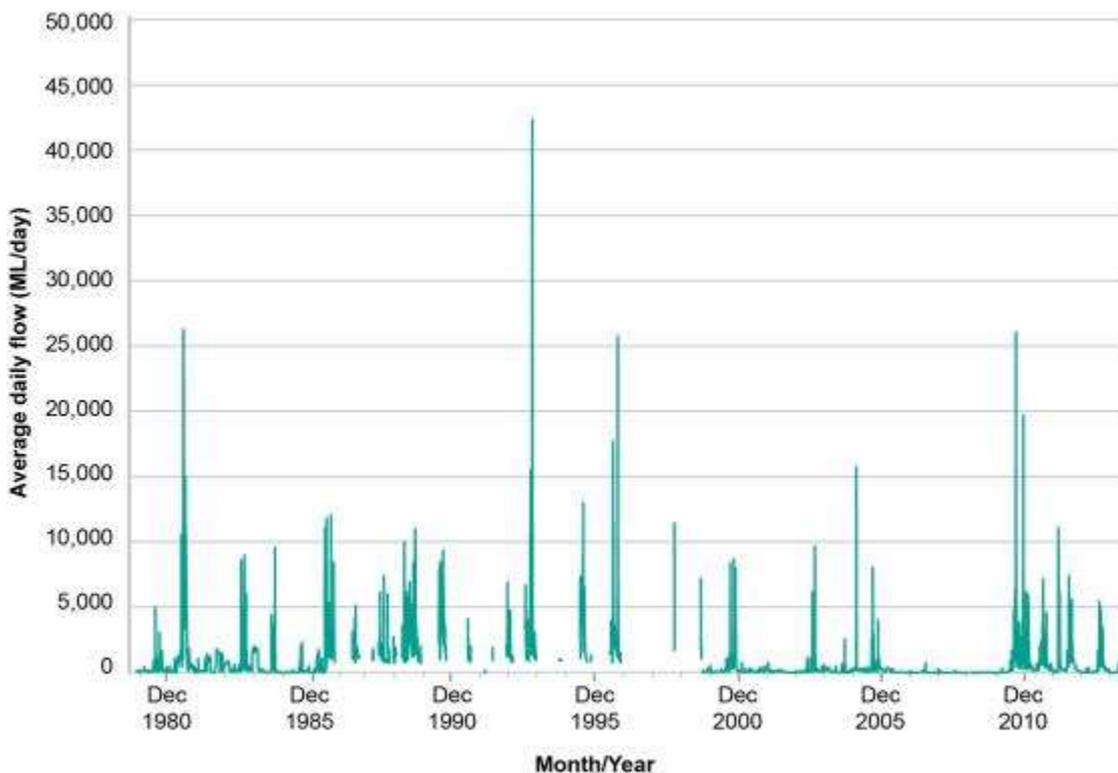


Figure 43 Average daily water flow in Broken River at Orrvale (gauging station 404222), December 1980 – December 2013

What could be affected by these flows

The following information about what might happen at different river levels is a guide only. Information has been sourced from community feedback, local flood guides and council reports, where available.

Below minor flood level — examples of areas affected by overbank flows below minor flood level include:

- localised flooding in some low-lying rural paddocks
- Raftery Road and Watts Road (back road between Shepparton and Mooropna) is closed when flows are about 18,000 ML/d
- first penstocks closed (at Princess Park north and south, Macguire Road, and Hassett Street)
- Welsford Street pump is turned on when the gauge height reaches 9.15 m.

Minor flood level — examples of areas affected by overbank flows around minor flood level include:

- localised flooding in rural paddocks
- penstock closure or pump operation (Creek St, Kialla Park, the Boulevard, Newton Street)
- Tom Collins Drive at Fitzjohn Road closed and Aquamoves car park affected at around 10.3 m.

What the community thinks about the suggested flows

Initial feedback from landholders suggests that flows up to **30,000 ML/d** may be a tolerable level of inconvenience flooding. This is subject to suitable mitigation measures being in place, such as improving the stormwater drainage system and addressing road access issues.

The flows between 25,000 and 30,000 ML/day, around minor flood level, could be created by releases from Eildon in combination with tributary flows. Tributary flows passing down the river could also be topped up by temporarily stopping the transfer of water into Waranga Basin and allowing it to continue to move downstream of Goulburn Weir (noting that this would be outside of the irrigation season and that environmental water entitlements held in Eildon Dam would still be debited for any water used this way).

Local councils and landholders in this region provided a number of other key points in relation to considering any change to regulated river flows.

Effects

The size of flows being considered is well within what the area naturally would have experienced.

Late season (September onwards) and extended duration flows (greater than a week) will increase effects on crops, levees and bank erosion Raised by several residents

There is a risk of more frequent watering leading to an increase in vegetation and bushfire risk — especially now that the national park is no longer grazed.

If an environmental flow came through and it was high enough to trigger pulling the Loch Garry bars, people would be very angry — not only because they would be being flooded and suffering damages and losses, but also because the Loch Garry landholders would be paying for the bars to get pulled.

Several Loch Garry landholders

Duration of water against the levees and river banks is a concern — the longer the levees are wet, the more bank slumping and riverbank slips that you see. If water stays up against the levees for a long time, there are also issues of water seepage through the levees. One farmer has experience of extended 'topping up' of a flow in New South Wales for 21 days — high flows for this long resulted in levee slumping

and collapse. Sharp and short is okay, but long duration leads to levee weakening, seepage and possible collapse.

Level of general community interest will change at different flows. (i.e. people at Shepparton will be interested as water appears in the floodways), but levels of community concern will increase as water levels increase, especially if water becomes very visible over large areas.

Access

Every flood is different. For example, the difference between the floods of 1973 and 1993 was huge. In 1973, it was very quick to travel between Shepparton and McCoy Bridge, but in 1993 it was much slower.

In a 'normal' year, winter rain prewets the country and one big rain in spring will bring floods.

As soon as the river goes overbank at Shepparton it can be hard for people to access boat ramps. And once the river level drops, they cannot access the foreshore areas for a while due to the wet boggy ground.

During picking season, there are often backpackers camping near the causeway bridge. Riverbank camping is very popular in and around the foreshore area of Shepparton.

There is a cycle path from Shepparton to Mooroopna that runs alongside the causeway (Midland Highway). Once flows close the cycle path then the cyclists are pushed onto the busy causeway. This can be quite dangerous. Also, when the bush under the causeway goes under, all the kangaroos came up onto the causeway and create a traffic hazard.

At 9.5 m at Shepparton (25,000 ML/d), water starts flowing into the Bunbartha/Deep Creek system and this causes concern for many of the landholders, especially if it water gets into Skeleton and Sheepwash creeks for extended durations. Water in the creek networks significantly affects how landholders can access their paddocks/crops and there are also a number of causeways on the smaller creeks that would become impassable.

Management

Is there enough predictability in the system for river operators to be able to top up unregulated flow pulses from the Broken River and Seven Creeks with sufficient confidence to control the peak and duration, and not cause unintended adverse consequences?

What the operators used to do is cut the flooding off really quick and there was lots of bank slumping. Then they started lowering it slower and now we don't see it as such an issue. After a drought followed by a flood then bank slumping is probably unavoidable. This highlights that we should always be monitoring bank slumping and maintaining levees.

Levees have contained and concentrated Goulburn River flows — making flows deeper and faster with more erosion.

*Everyone relies on the levees, yet no-one else will contribute to help fix them, and we can't go out and fix them ourselves as there is so much red tape.
Several landholders regarding levee maintenance*

The ownership of the levees is so critical. The amount of debates and anxiety about levee maintenance is huge. This needs to be resolved before the community has confidence that they can withstand higher flows. The levees will need to come under someone's responsibility and preferably not landowners.

A range of protective levee concerns include proximity to the outside of river bends, levees right at the top of the riverbank, riverbank slumping and eroding levees. Levee integrity is also being affected by tree growth, lack of vegetation cover, tracks, animal burrows, etc., which create points of weakness.

