Killingworth to Mitchellstown

At a glance

The flow footprints constraints work is investigating are between 15,000 and 30,000 megalitres/day (ML/d) between the Killingworth gauge on the Goulburn River and Mitchellstown, including the flow contributions of tributaries. Extended duration releases from Lake Eildon and releases on top of high tributary flows are not being investigated. Flow footprints higher than 30,000 ML/d are not being investigated (e.g. flows greater than 4.5 m at Seymour, gauging station 405202). 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 the 20,000 ML/d flow footprint may be somewhat underestimated.

Initial feedback from landholders suggests that flow footprints up to 20,000 ML/d (e.g. 3.6 m at Seymour, gauging station 405202) may be a tolerable level of inconvenience flooding, if stormwater drainage issues at Seymour are addressed as well as any inundation of private land. The flow footprint up to 20,000 ML/d, nearing minor flood level, may occur through a combination of releases from Eildon with no tributary inflows, tributary flows on their own, or a mix of tributary flows and Eildon releases.

Reach characteristics

This subreach flows from the Killingworth gauge on the Goulburn River (405329) to Mitchellstown (Figure 25). Four creek and rivers contribute flows to the Goulburn River, including Yea River (and Murrindindi River, which joins the Yea), King Parrot, Whiteheads and Sunday creeks (and Sugarloaf Creek, which joins Sunday Creek). These tributaries are unregulated, and rise and fall rapidly in response to rain.

The town of Seymour is located in this stretch of the Goulburn River, right on the Goulburn floodplain. The town has been moved to higher ground three times because of flooding. Floods in 1847, 1870 and 1916–17 caused the town's commercial centre to be moved. However, since 'Big Eildon' dam was built in 1955, its water harvesting operations have greatly reduced the impact and frequency of minor and moderate Goulburn River floods occurring in Seymour.

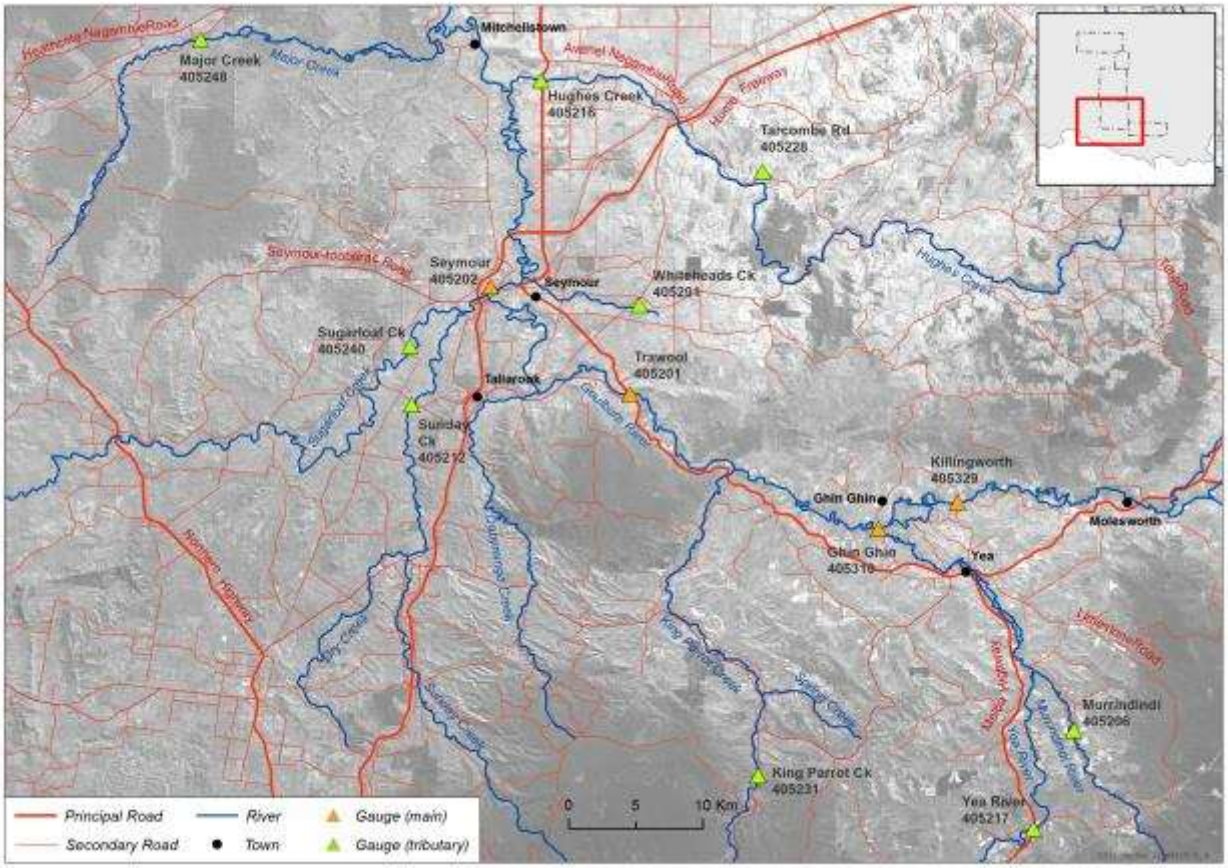
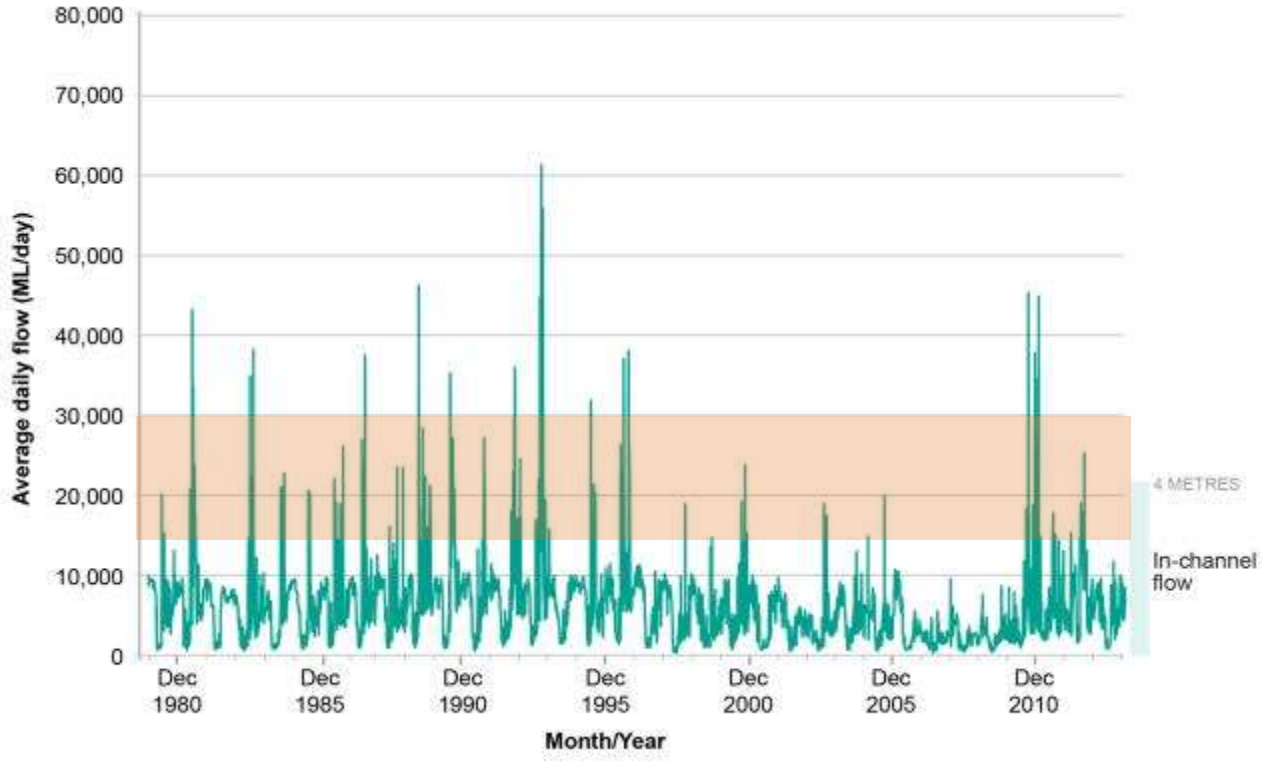


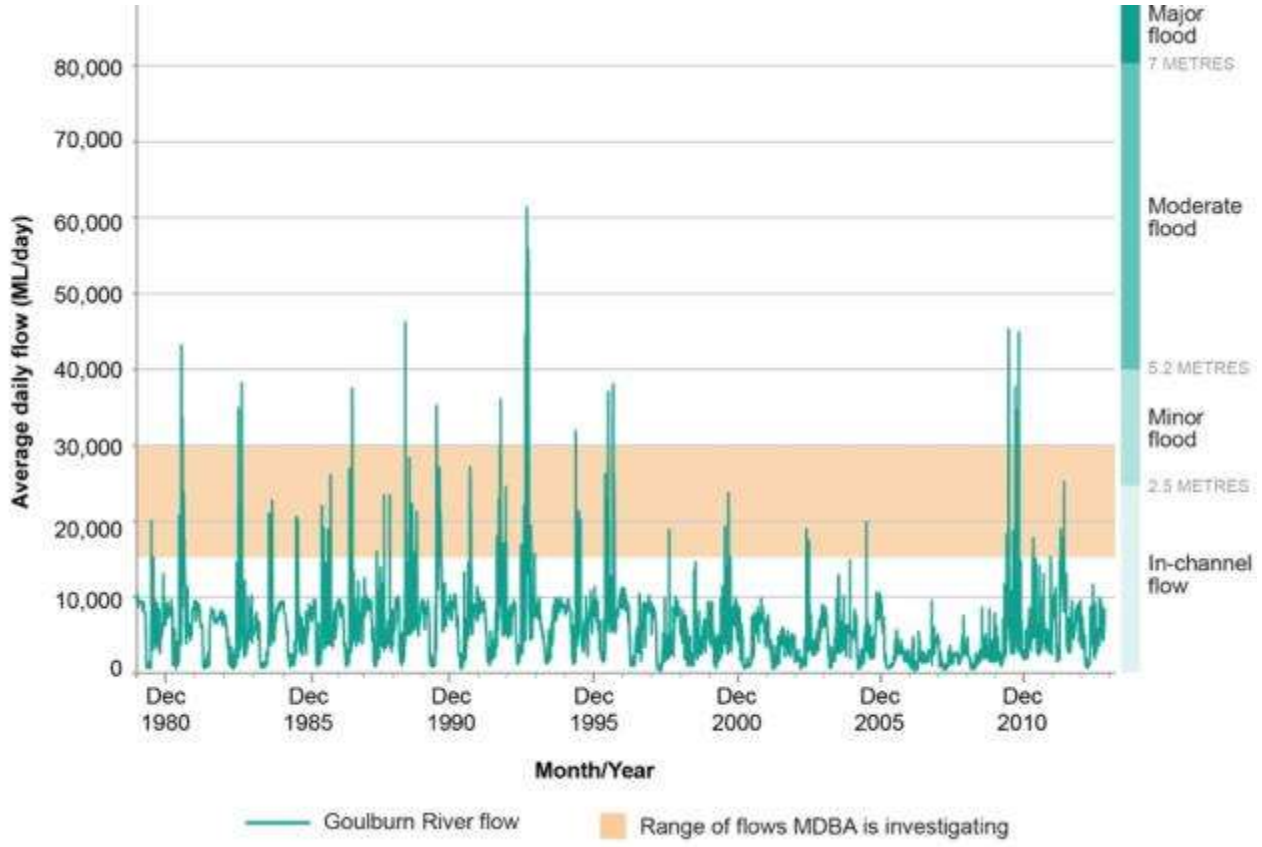
Figure 25 Killingworth to Mitchellstown subreach

There are four flood gauges in this subreach that are used by the Bureau of Meteorology for flood forecasting purposes. Two are located on the Goulburn River at Trawool and Seymour, one is located at Sunday Creek at Tallarook, and one at Whiteheads Creek at Seymour. The river flows recorded at the Goulburn River gauge at Trawool and Seymour between 1979 and 2013 can be seen in Figure 26 and Figure 27.



Note: The shaded box outlines the range of flows that MDBA is investigating (15–30,000 ML/day).
Noting that as you move away from the gauge, the river situation can be quite different from what is being recorded at the gauge.

Figure 26 Flows in the Goulburn River at the Trawool gauge, 1979–2013



MDBA = Murray–Darling Basin Authority; ML = megalitre
Note: The shaded box outlines the range of flows that MDBA is investigating (15–30,000 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 27 Flows in the Goulburn River at the Seymour gauge, 1979–2013

The previous major floods recorded by gauging station 405202 at Seymour occurred in 1974 (7.64-m peak) and 1975 (7.03-m peak), flowing at more than 80,000 ML/d. Historically, floods have gone even higher, such as in 1916, when flows were above 8 m. As can be seen from Figure 27, moderate flooding at Seymour has occurred five times since 1979, with the most recent event in September 2010. In 2010, flood levels peaked at 6.2 m, flowing at 58,700 ML/d. These historical data are presented in Table 8, 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 8 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 8 Example recorded flows for Goulburn River at Seymour (gauging station 405202)

Flood class	Date	Gauge height (m)	Flow (megalitres/day)	Is constraints work considering these sorts of flows?
Major	18 September 1975	7.03	81,985	No
Moderate	20 September 1993	6.65	70,298	No
Moderate	5 September 2010	6.21	58,714	No
Moderate	1 October 1996	5.33	42,034	No
Minor	19 August 2012	4.04	25,260	Yes
Below minor	2 September 2005	3.61	20,487	Yes

Heavy rainfall can rapidly increase flows in several tributaries near the Seymour flood gauge, and these flows regularly affect riverbank farmers and the Seymour township. For example, in February 2012, heavy rainfall (130–170 mm on local gauges) caused the Whiteheads and South creeks to burst their banks in Seymour. The flows from the tributaries (but not the Goulburn River) caused extensive damage and made the township almost impassable. The flood risk to Seymour from the Goulburn River and its tributaries is now being addressed by the Seymour Flood Mitigation Project. This project is supporting the design and construction of a levee bank to protect the area of Seymour between the railway line, Whiteheads Creek and the Goulburn River.

What flows are being considered

Constraints work is investigating flow rates between 15,000 and 30,000 ML/d (e.g. 3.1–4.5 m at Seymour gauging station 405202) (Table 9 and as indicated by the shaded box on Figure 27).

This would be overbank flows up to 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 inundated, 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 9 Comparison of flow footprints for the Killingworth to Mitchellstown subreach and flood categories at the Trawool and Seymour gauges

Measure	Flow footprints being looked at for the Killingworth to Mitchellstown subreach (that include the flow contribution of tributaries)			Minor flood level[1]	Moderate flood level[1]	Major flood level[1]
				Trawool		
Flow rate (megalitres/day)	**15,000**	**20,000**	**30,000**	21,700	41,500	83,000
e.g. Gauge height (m) at Trawool	**3.1**	**3.8**	**4.8**	4.0	5.6	7.5
				Seymour		
Flow rate (megalitres/day)	**15,000**	**20,000**	**30,000**	24,850	40,000	81,310
e.g. Gauge height (m) at Seymour	**3.1**	**3.6**	**4.5**	4.0	5.2	7.0

MDBA = Murray–Darling Basin Authority

[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 occurred more frequently in the past. The hydrographic record shows that flows around the minor flood level have happened more than 15 times since 1979. They are therefore not an unusual type of flow. People in the region are already managing through flow events of this size at least every few years.

What these flows look like

Linking a gauge reading at Seymour 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 to be an initial representation of what could get wet for a flow of a particular size.

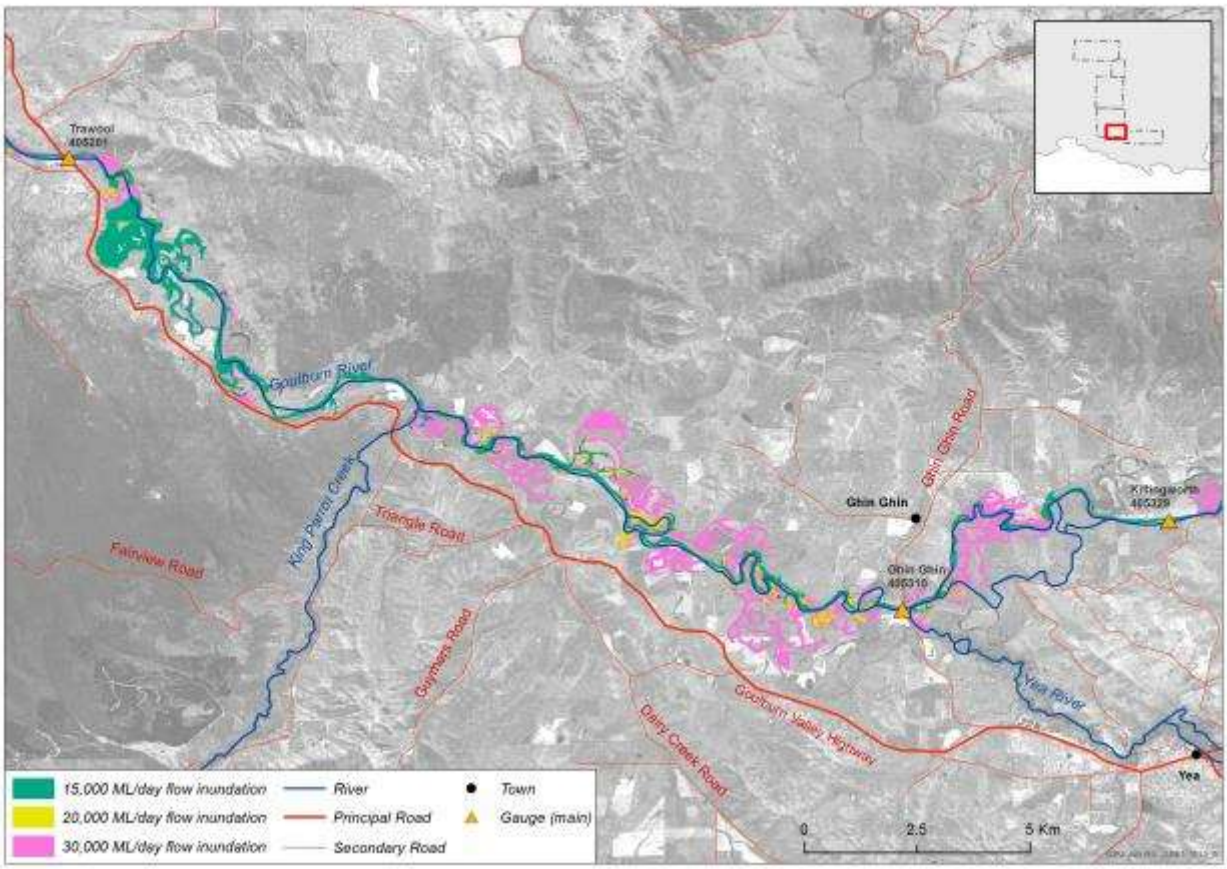
Figures 28a and b show flow footprint maps for 15,000, 20,000 and 30,000 ML/d flows downstream of Killingworth to near Mitchellstown.

The maps show a number of river flats and anabranches being inundated downstream of Ghin Ghin Bridge towards Trawool. Downstream of Trawool and past Seymour, a much smaller area of river flats and anabranches are inundated. This is because the channel capacity of the Goulburn River increases as you move downstream.

Feedback from local councils and landholders was that the flow footprint maps looked about right, although the 20,000 ML/d flow footprint may be somewhat underestimated.

Due to modelling assumptions, the maps did not capture the possible effect of the tributaries backing up (not being able to drain freely due to high Goulburn River levels). If work in the Goulburn proceeds, then additional modelling of potential inundation of land in tributaries should be included. This is particularly important for Seymour and the effective operation of its stormwater drainage system.

The accuracy of the maps is currently limited by the amount of data available to calibrate the hydraulic model. Mapping accuracy is particularly an issue for the mid-Goulburn, as calibration data were limited. The maps should therefore be viewed as a first estimate, with more accurate mapping required.



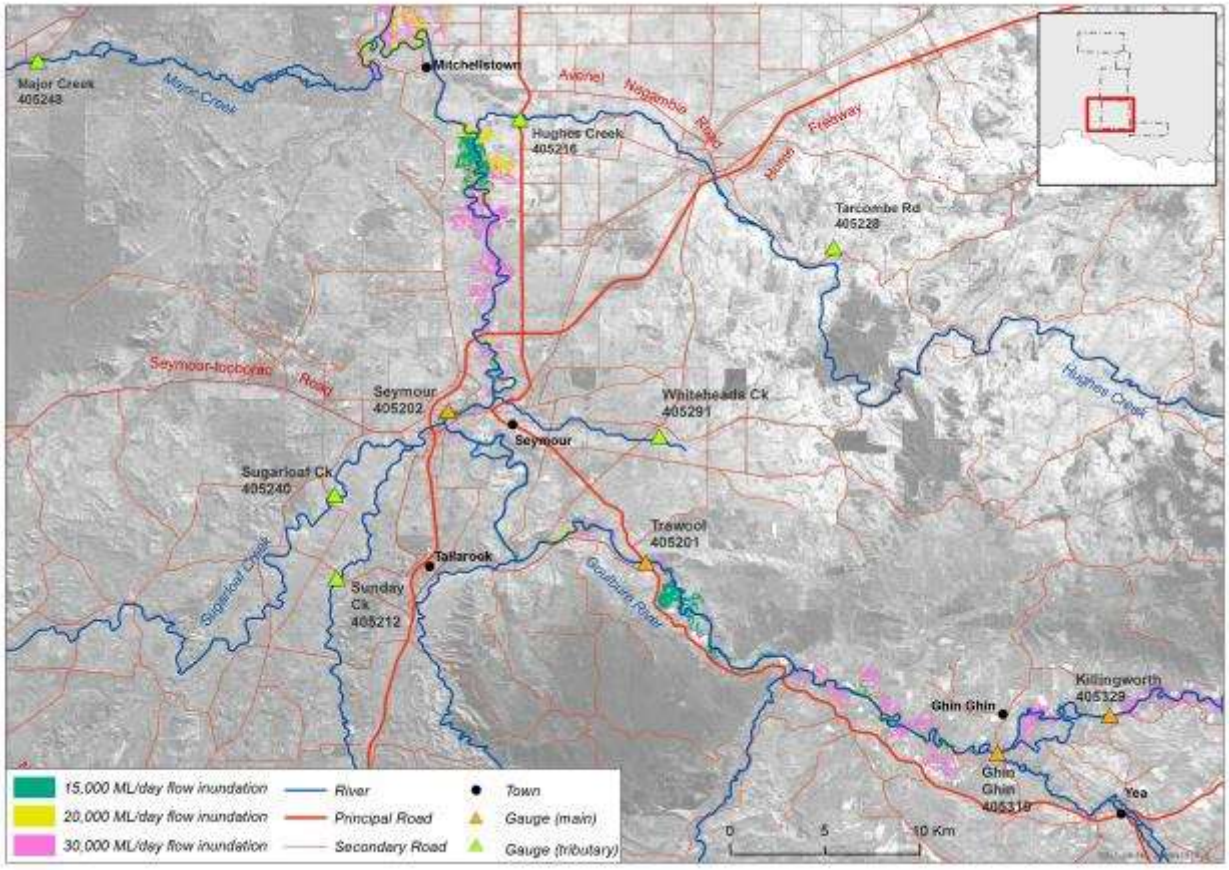


Figure 28 a and b **Flow footprints for flows of 15,000, 20,000 and 30,000 megalitres (ML)/day between Killingworth and Mitchellstown**

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.

Yea River

The Yea River has a catchment area of 360 km^2. The catchment includes the Murrindindi River, which is a tributary to the Yea River. The Yea has one gauge at Devlins Bridge, but located a considerable distance upstream from the confluence with the Goulburn River (over 20km). This gauge has 30 years of instantaneous data, classified as 'good'. The mean daily flow for July–November is 476 ML/d (Figure 29). The Yea contributes 6.3% of the flow measured at Trawool. The 'peakiness' ratio value of the catchment is 8.52.

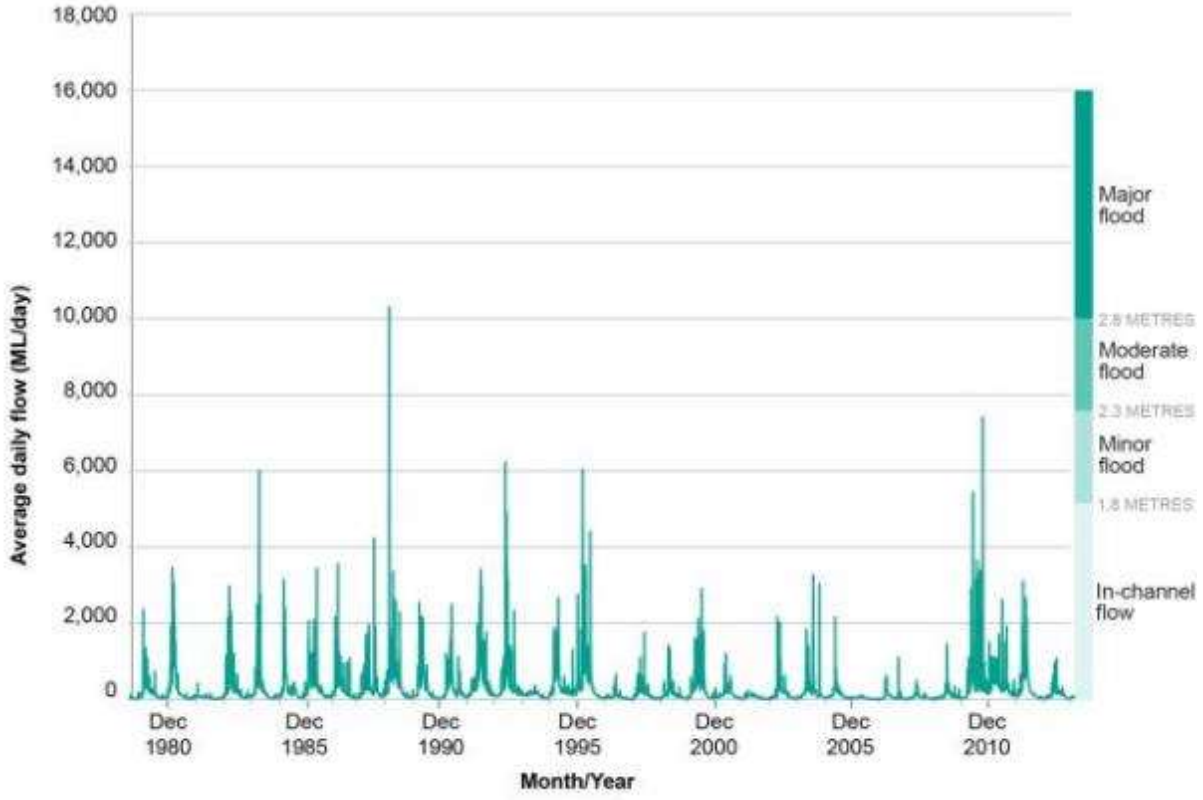


Figure 29 Average daily water flow at Devlins Bridge, 23 km south of Yea (gauging station 405217), December 1980 – December 2013

King Parrot Creek

King Parrot Creek has a catchment area of 181 km^2. The creek has one gauge at Flowerdale. This gauge has 29 years of instantaneous data, classified as 'good'. The mean daily flow for July–November is 165 ML/d (Figure 30). King Parrot Creek creek contributes 2.2% of the Goulburn flow at Trawool. The 'peakiness' ratio value of the catchment is 11.09.

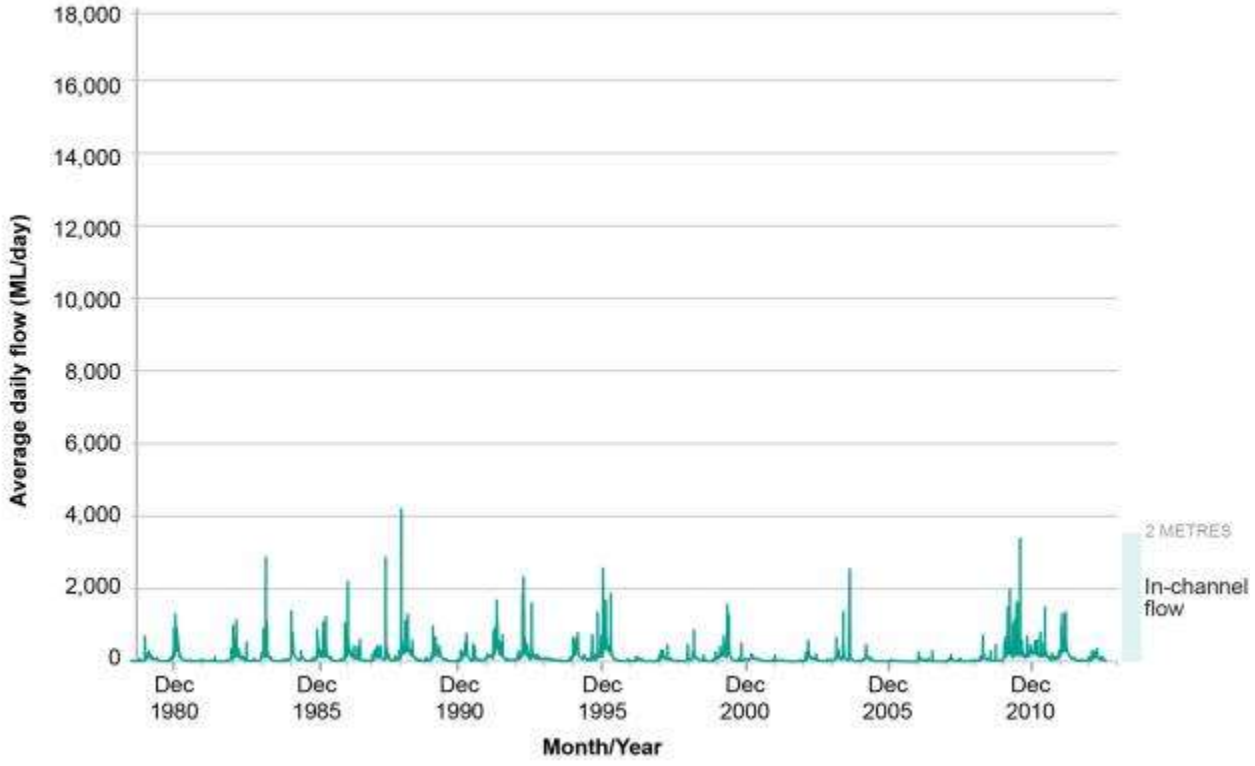


Figure 30 Average daily water flow in King Parrot Creek at Flowerdale (gauging station 405231), December 1980 – December 2013

Sunday Creek

Sunday Creek has a catchment area of 337 km^2. The catchment includes Sugarloaf Creek, which is a tributary to Sunday Creek. The creek has one gauge at Tallarook. This gauge has 45 years of instantaneous data, classified as 'good'. The mean daily flow for July–November is 173 ML/d (Figure 31). The 'peakiness' ratio value of the catchment is 32.73. It has a low baseflow index, typical of the more intermittent flow regime of the tributaries in the lower part of the mid-Goulburn towards Goulburn Weir (0.29).

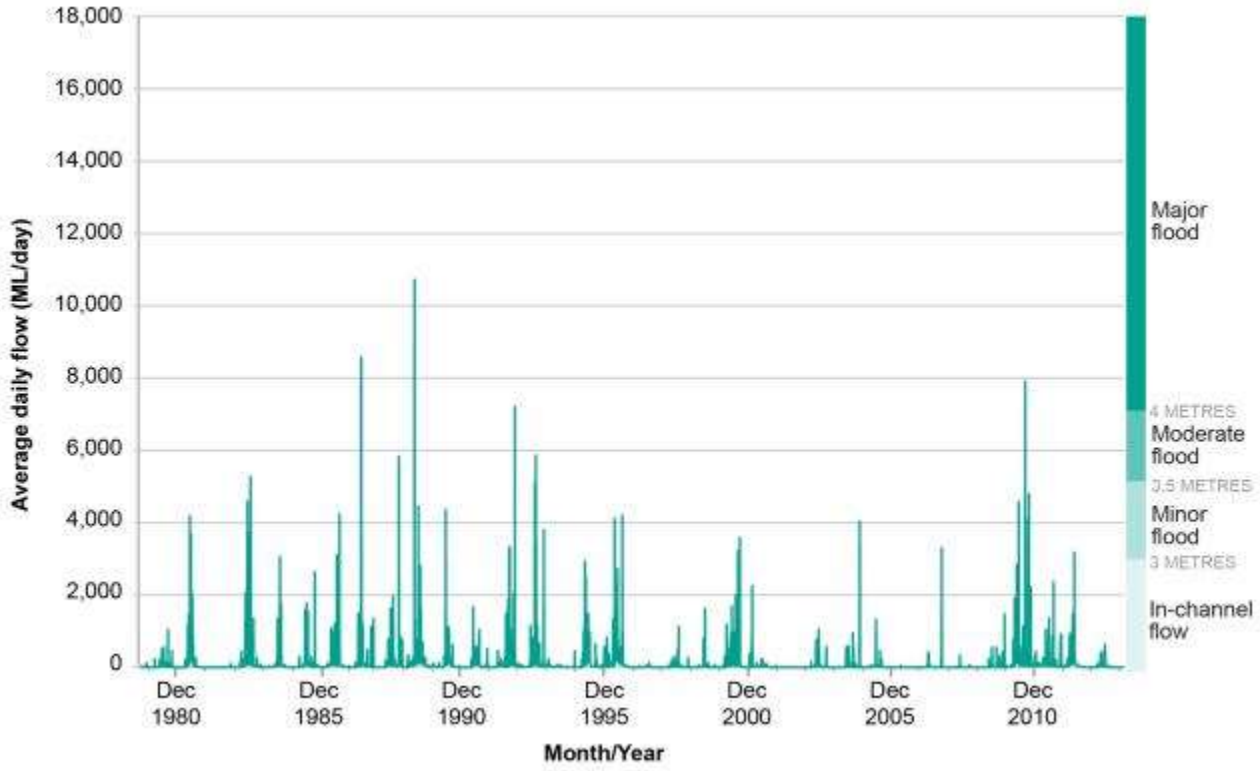


Figure 31 Average daily water flow in Sunday Creek at Tallarook (gauging station 405212), December 1980 – December 2013

Sugarloaf Creek

Sugarloaf creek is a tributary to Sunday Creek. Sugarloaf Creek has a catchment area of 609 km^2. The creek has one gauge at Ash Bridge. This gauge has 33 years of instantaneous data, classified as 'good'. The mean daily flow for July–November is 331 ML/d (Figure 32). The 'peakiness' ratio value of the catchment is 39.99.

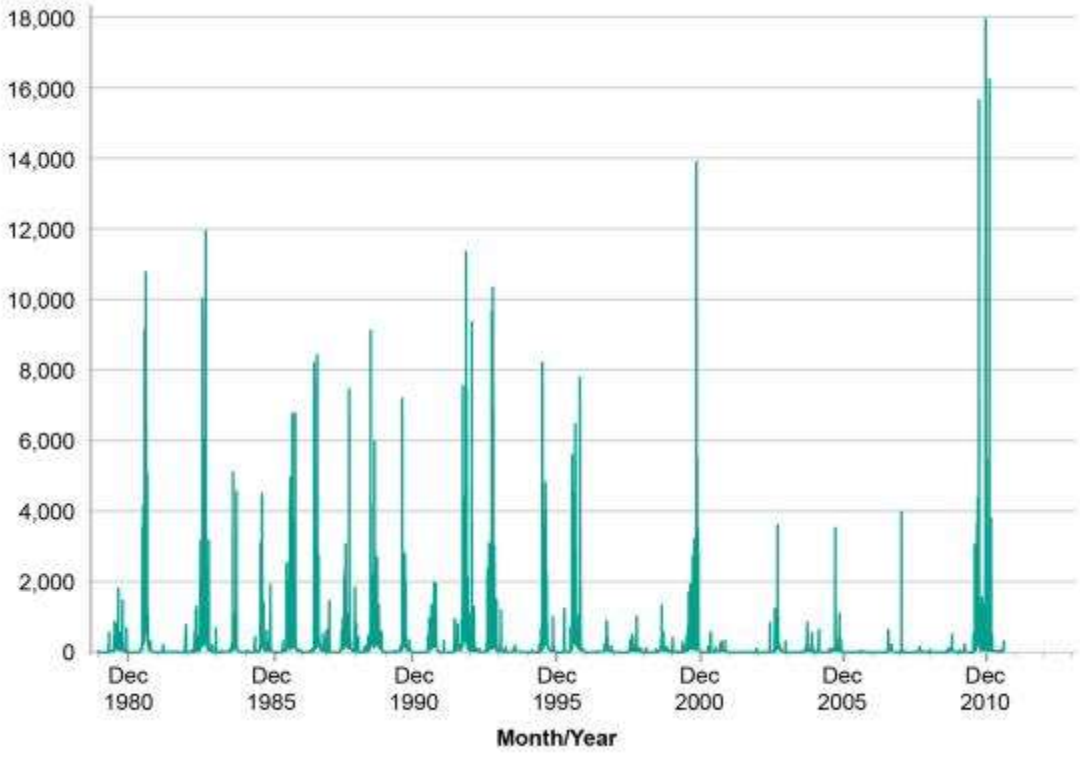


Figure 32 Average daily water flow in Sugarloaf Creek at Ash Bridge (gauging station 405240), December 1980 – December 2013

Whiteheads Creek

Whiteheads Creek has a catchment area of 51 km^2. The creek has one gauge at Whiteheads Creek. This gauge has 16 years of instantaneous data, classified as 'good'. The mean daily flow for July–November is 46 ML/d (Figure 33). The 'peakiness' ratio value of the catchment is 20.04.

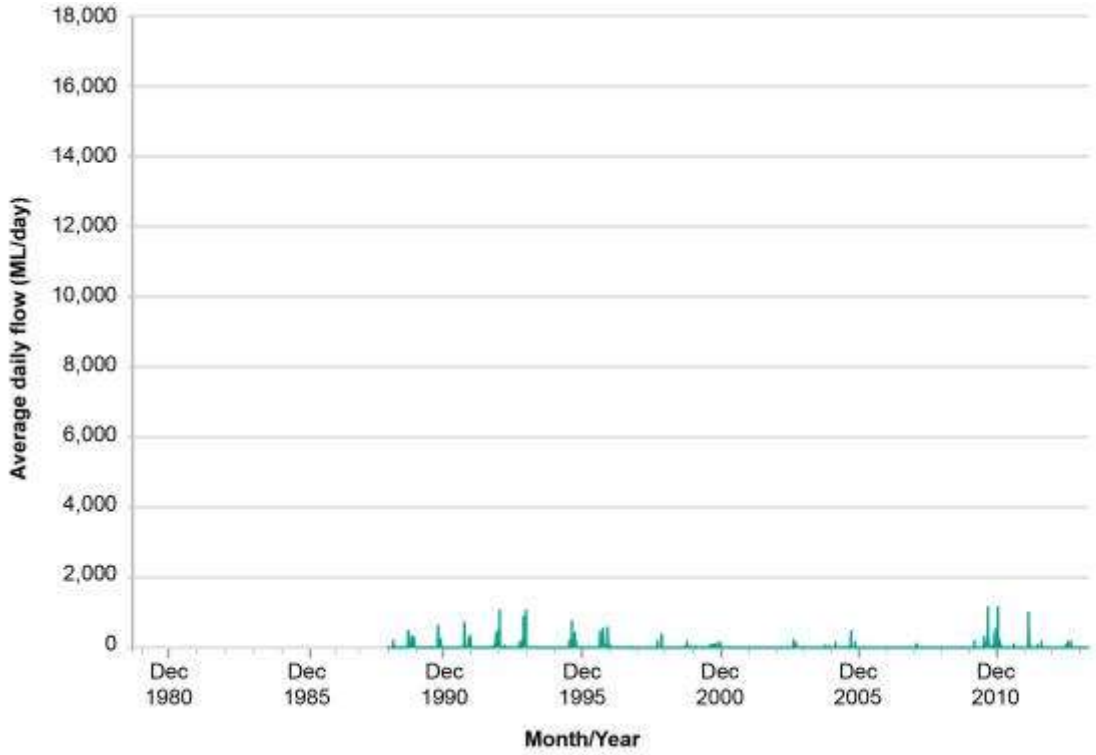


Figure 33 Average daily water flow in Whiteheads Creek (gauging station 405291), December 1980 – December 2013

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.

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

- localised flooding in rural paddocks
- Goulburn River Caravan Park, Seymour, starts to flood
- river frontage at Seymour starts to experience localised flooding, especially between Kings Park and the old Hume Highway
- Seymour stormwater drainage starts to be affected.

What the community thinks about the suggested flows

Initial feedback from landholders suggests that flows up to **20,000 ML/d** may be a tolerable level of inconvenience flooding. This is subject to stormwater drainage issues at Seymour being addressed, as well as any inundation of private land.

The flow footprint up to 20,000 ML/d, nearing minor flood level, could be created by releases from Eildon with no tributary inflows, tributary flows on their own, or a mix of tributary flows and Eildon releases.

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

> *Drainage is the main issue for Seymour. Whiteheads Creek flows right through the town. When the Goulburn River is running high, Whiteheads Creek cannot drain freely into the Goulburn and ends up backing up the creek. Problems with Whiteheads Creek and stormwater drainage start at around minor flood level.*

> *When river flats get inundated by the river, it takes time for the silt to be washed from the pasture so that cattle will eat it again. This changes how and when paddocks can be rotated and used, and therefore directly affects the fattening of cattle.*

> *River flows can wash away fertiliser applications and bring in weed species. This means extra cost and time to farmers to re-apply fertilisers and manage weeds.*

> *Mitchell Shire Council is in the process of developing designs to build a flood levee around Seymour. The levee will provide flood protection to the township for flows much higher than the minor flood level that the Constraints Management Strategy is considering.*