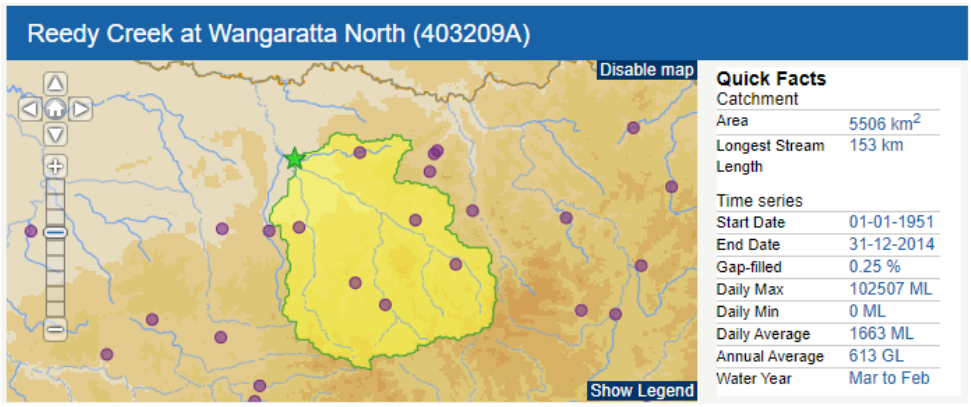
Deciding data to include for catchment 403209A

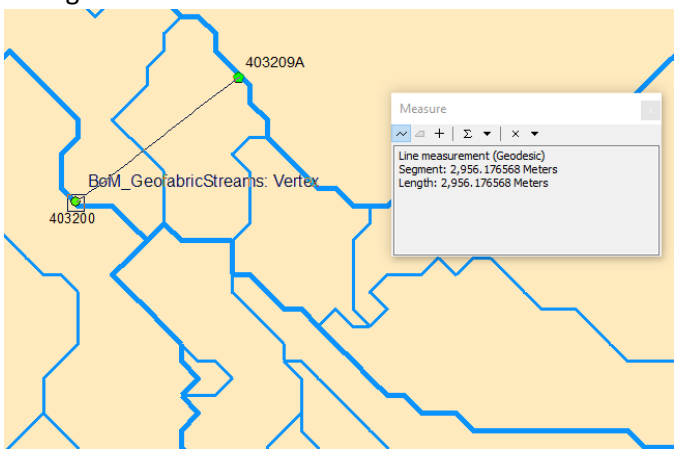
Keirnan Fowler, University of Melbourne, 13/04/2020

The gauge 403209A, Reedy Creek at Wangaratta North, is a difficult case. Consider the following:

- The HRS site (as at 13/04/2020) marks the catchment area as 5506 km². Given Reedy Creek is a minor tributary of the Ovens River, this is far too high. The polygon on the BoM location map marks the catchment area of 403209A as all of the Ovens catchment area upstream of Wangaratta. Thus, whatever automatic delineation technique they used has issues.



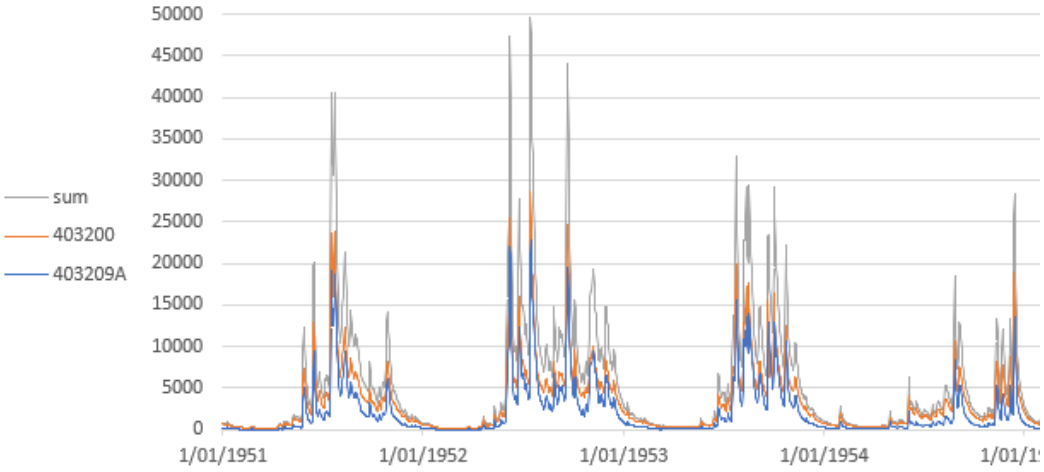
- Indeed, my own automatic delineation technique got the same answer, and this is why my PhD thesis marks 403209A as not included in the PhD study because there "appears to be an error in either gauge location or catchment delineation." (p239).
- The nearby gauge 403200 (Ovens River at Wangaratta) would appear to be the main gauge in the area; its name implies that it is on the main stem of the Ovens. Could it be that the two gauges coordinates got mixed up?
- No. It not simply a case of mistaken identity. A closer look at the local topography reveals very flat ground with numerous anabranches. The two gauges 403200 and 403209A are 3km distant and the channels of the Ovens River and Reedy Creek are crisscrossed by anabranches. This suggests possible hydrologic connections between the two channels.



- The idea that the channels are connected is supported by multiple lines of evidence:
    - The reported flow past 403209A is far too high to be sourced from Reedy Creek only. Comparing with gauge 403221 (Reedy Creek at Woolshed), Reedy Creek at Wangaratta ought to have around double the catchment area and less than double the flow (since it

rains more upstream of Woolshed). Yet the reported flow on the BoM HRS site is 18 times higher! (34 GL/yr at Woolshed; 600 GL/yr at Wangaratta North).

- Also, previous studies have hypothesised that flow is shared between the tributaries. For example, the eWater report here notes that their rainfall runoff model applied at 403209 underestimated flows by 80% and noted it is "possible that this gauge incorporates high flows from the Ovens River" (p41).
- However, the hydrographs of the two gauges suggest otherwise. If water sharing only occurred at high flows, we would expect a spike in the blue timeseries during high events. The fact that the two hydrographs largely mirror each other suggests water sharing across the range of the flow regime, not just at high flows.



What is to be done about all this? The choices are:

1. Do not include this gauge in CAMELS-AU. The problem with this option is that the total number of catchments in the sample will be one less than the HRS tally (221 not 222), which could cause confusion among users already familiar with HRS. Further, since the HRS tally is 222 in the latest version and 221 in the original version, the altered number of catchments may cause readers familiar with HRS to assume we are using the outdated version. These potential sources of confusion mean that this option was not adopted.
2. Adopt a different catchment area, corresponding only to Reedy Creek. The problem is that the flows are far too high (even exceeding rainfall I think!).
3. Adopt the catchment area as shown above and the 403209A flows unaltered. The problem is that the flows are too low because they only account for part of the outflow from the area.
4. Adopt the catchment area as shown above, but alter the flow timeseries to be the sum of the two gauges. Potential issues include:
    - Differences between official flow data and CAMELS-AU. Solution: inclusion of this document in the repository.
    - Concerns over whether the Ovens River at Wangaratta would have met the original criteria for HRS. Comments: it perhaps wouldn't have (due to reservoirs, see below), but for CAMELS-AU it is interesting to include this large catchment since there are few unregulated large rivers in this part of Australia. Admittedly the catchment has many, many farm dams (but not as high a density as some other HRS catchments), groundwater extractions (but these are only 12.3 GL/yr or <1% of MAF, see here) and small bulk reservoirs (William Hovell, 13.5 GL, and Lake Buffalo, 23.5 GL, combined capacity of 2.1%

MAF). None of the above factors appear terminal. Note, anecdotal evidence suggests it was also subjected to land use change (particularly growth in forestry plantation) over the recorded period, but such changes do not seem to appear in the DLCD dataset (included in CAMELS-AUS) so there appears little evidence for disqualification due to landuse change.

Despite the noted issues, #4 is the selected option.