

# **Major revisions to HESS-461-2021: A hydrological framework for persistent pools along non-perennial rivers, Bourke et al.**

Dear editor,

Thank you for the opportunity to revise this manuscript. We have made substantial revisions to the manuscript in response to the reviewers' comments. We found the comments from the community (the students' reviews) most helpful, as they covered most of the same issues as the reviewers but provided thoughtful and constructive suggestions for how to improve clarity of organisation. The key criticisms and a summary of the changes made are as follows.

We hope that the manuscript is now suitable for publication. In addition to the conceptual framework this paper was originally conceived as, this manuscript now includes an extensive review of literature and field methods relevant to the hydrology of persistent river pools, as well as a substantial demonstration of the application of this framework in the Hammersley Basin using both regional-scale and pool-scale techniques (comprising a substantial novel-data component). While reviewers may pick out small deficiencies in individual components, we believe that this now forms a comprehensive (and long) manuscript that presents a framework of ideas and their application with links to find more information and further considerations on each sub-component that will continue to be useful for the scientific community.

## **Summary of revisions**

### **Manuscript structure and integration of sections**

The order of sections has been revised in-line with the reviewer's recommendation so that the management implications with respect to susceptibility of pools is now before the description of available tools for identifying hydraulic mechanisms.

The description and critique of available tools is now separated into regional-scale and pool-scale tools in acknowledgement that detailed sampling at specific pools is not always possible or required depending on needs of a given study or assessment.

We have also added a separate discussion section after the case study as suggested.

The case study section itself (Section 5) now includes a section explicitly describing the application of regional-scale tools to Hammersley Basin region, followed by the three pool-scale case studies. This division between regional- and pool-scale tools is consistent with the revised section on available tools (Section 4).

### **Manuscript Text**

A substantial portion of the text has been updated inline with specific comments made by the reviewers (and community members). These changes have focussed on improving clarity and accuracy, as well as adding citations where suggested.

The aim and objectives described in the Introduction have also been updated to reflect the new structure of the manuscript.

The manuscript now refers to m asl (above sea level) rather than the equivalent commonly used in Australia, m AHD.

A new discussion has been added which begins by summarising what has been achieved in the manuscript. It then discusses some additional considerations (e.g., that although we have striven to go back to the basic concepts, there may be more than one mechanism contributing to pool persistence)

and suggests that multiple methods from Table 2 be used, demonstrating with the synthetic example how the interpretation of just one type of data may lead to an erroneous conclusion. We also acknowledge the difficulties of conducting fieldwork in the environments that host non-perennial rivers and how limitations of time and funding may call for trade-offs between detail and quantity in data. We then tie all these considerations back to what we learned from the case studies, thus linking the paper together more fully as requested by the reviewer.

The conclusion has also been substantially revised to better reflect the key outcomes of the paper, consistent with the revised objectives in the Introduction.

### **Figures and Tables**

All of the figures in the manuscript have been revised in line with the reviewers' comments to improve clarity and consistency and we have also created new figures and tables.

The conceptual diagrams in Fig 1-4 have been updated to have alluvium labelled rather than alluvial channel, as suggested. We have also used consistent colours for geological layers and clarified impermeably vs permeable basement/bedrock as well as improving the placement and formatting of arrows and surface drainage features.

The map of the Hammersley Basin (Fig 5) has also been updated in line with reviewer comments, and there is now a map showing the locations of pools relative to geological strata (Figure 7), which also includes an inset of NDVI results. The previous figure of photos showing the different types of pools has now been unpacked (see Figs 6, 8, 9) and is accompanied by text describing the regional-scale assessment in a structure that links to the regional-scale tools described in section 4.

We have also moved Table 1 further up the manuscript and created a new table (Table 2) summarizing the available tools so that the reader can rapidly assess which they might find useful for a given study, as suggested. We have also added a table of hydraulic conductivities of the geological formations described in the case study section.

Following reviewer comments questioning the importance of the water balance equations, we have now included text and a figure (Figure 14) in the discussion to describe the importance of an accurate understanding of pool water balance components when interpreting measured data.

### **Additional comments**

We considered all of the reviewers' comments and suggestions thoroughly; there were a small minority that we have not made changes in response to:

- We believe that the word “framework”, defined as a hypothetical description of a complex entity or process, accurately describes the nature of this manuscript and have therefore not altered the title and continue to use this word in the manuscript.
- The hydrological framework presented in Table 1 was developed primarily from first principles. As such we believe that it is most appropriate to retain the references provided within the accompanying text, rather than adding references to the table.