A Summary of Revisions and Responses to the "Identification of watershed priority management areas based on landscape positions: An implementation using SWAT+" (Ref: HYDROL48272R1)

With regards to comments from the Editor:

"Both previous referees have reviewed your revised manuscript and found that you thoroughly addressed most of their major concerns. Reviewer #3 has suggested only a few minor editorial comments that need to be addressed, however, reviewer #1 would like more justification on the novelty of the contribution and why farm/plot scale was not used. I think you can try to address these remaining concerns through your introduction and discussion sections."

Thanks for the editor's suggestion. For the concerns of Reviewer #1, we revised the manuscript to clarify the novelty of proposing landscape position units (LSUs) within subbasins to identify PMAs and explain the logic of the "basic idea-method design-exemplified implementation" of this proof-of-concept study. We also explained that farm or plot units are realistic spatial units for implementing BMPs which does not contradict the proposed PMA identification method based on watershed modeling and landscape position units. We also checked and revised the manuscript according to the editorial comments from Reviewer #3.

We hope the revised manuscript can reasonably solve the concerns of the editor and Reviewer #1.

With regards to comments from Reviewer #1:

"The authors have done a great job in revising this paper. However, I still think the combined application of SWAT+ and the Markov chain is not new."

Thanks for the reviewer's approval and comments. This study is a proof-of-concept study, as the reviewers' approval on the previous version of this manuscript, in which the basic idea is using landscape position units (LSUs) within subbasins to identify PMAs; the method design is improving the Markov chain-based statistical model to surrogate the watershed model to quantify the pollutants released at LSUs and distinguish the source contribution to the assessment outlet; the exemplified implementation is based on the SWAT$^+$ model. We discussed with the literature review to address the novelty of the basic idea. The combination of the recently-developed SWAT$^+$ model with the improved Markov chain-based PMA identification method is also the first, which achieved in satisfactory application results, as shown in the case studies in the manuscript. We have revised the manuscript to clarify the logic organization from the basic idea to the method design and the exemplified implementation. The revisions are as follows:

1) The first two sentences in the last paragraph of Section Introduction: "This study proposes a PMA identification method based on landscape position units and evaluates the effectiveness of the proposed method by comparing it with the adoption of widely used subbasin units. The remainder of this paper is organized as follows: Section 2 introduces the proposed method together with the exemplified implementation based on the SWAT$^+$ model…."

2) The added fourth paragraph of Section 2: "In this study, the exemplified implementation of the improved Markov chain-based PMA identification method adopted the SWAT$^+$ model to construct the transition matrix and quantify the pollutants released. Section 2.1 first introduces the ability of the SWAT$^+$ model to delineate and represent landscape position units. Section 2.2 then elaborates on the proposed method to derive pollutant load contribution of landscape position units to the watershed outlet, taking the SWAT$^+$ model as an implementation example."

"Besides, farm or plot scale is better for PMAs and BMPs."

We agree that farms or plots are realistic spatial units for implementing BMPs and evaluating the effectiveness of BMPs in both experimental and modeling studies. Although field observation is the most accurate approach to investigating the pollutant released at the farm or plot level, the pollutant contributions from upstream farms/plots to downstream channels are difficult or even impossible to observe directly. Therefore, the PMA identification methods are primarily based on watershed modeling because the definition of PMA emphasizes propagation effects from upstream to downstream in the watershed.

The key point in the PMA identification method based on watershed modeling is to determine an appropriate type of spatial unit as a modeling unit for pollutant production and contribution to the assessment outlet. From the literature review, we summarized three principles in selecting proper spatial units for PMA identification (see the 6th paragraph in Section Introduction). The last but most important one is the spatial units should have hydrologic connections among each other that existing watershed models can explicitly represent. From this perspective, we proposed to use landscape position units as PMA identification units.

Besides, the PMA identification units are not necessarily consistent with the realistic implementation units of BMPs or the simulation units of watershed models (Zhu et al., 2019). For example, the nonstructural BMP of returning farmland to forest configured on the PMA (identified by subbasin units) is implemented on the farmland with a slope above 15° within this subbasin and represented at HRU units using the SWAT model (Chen et al., 2022).

Therefore, farm or plot units are realistic spatial units for implementing BMPs which does not contradict the proposed PMA identification method based on watershed modeling and landscape position units.

We have made revisions in the second and 6th paragraphs of the Section Introduction to clarify the point.

We hope these explanation and revisions are acceptable to the reviewer.

With regards to comments from Reviewer #3:

"The authors have reasonably replied to my earlier comments and I think the paper can now be accepted with a few minor (editorial) revisions as detailed in the attachment. There is no need for me to re-review this paper again."

Thanks for the reviewer's approval and careful editing. We have revised the manuscript accordingly.