Reply to Referee #2

Wenlong Wang on behalf of all co-authors

Dear author I found your paper of interest and a good piece of science. I suggest some updates that are necessary in my opinion. Please, check the comments on the figure's layout. You can improve and make the figures more relevant. The introduction and discussion sections are based on old and European researches, and in the last five years scientists from Iran, China and Ethiopia developed new research on gully geomorphology, hydrology and spatial distribution I recommend to update your literature review.

Response: We particularly appreciate your recognition of our study. We have checked all the figures and updated them according to your opinions. The specific modifications can be checked in Q6-Q11, and we will also modify and update them in the revised MS. In addition, in the introduction and discussion section, we will add the literatures involved gully erosion, gully geomorphology, hydrology and spatial distribution in the last five years (published in China, Iran, Ethiopia and other countries) in the future revised manuscript. Thank you very much again.

The following questions was list according to the PDF file named by "hess-2020-412-RC2-supplement" provided by Reviewer 2#.

Q1. L50-The literature used in the introduction is the right one but is mainly focuses in an West European perspective. There are researchers in Ethiopia, China and Iran that recently published relevant papers that should be mentioned. In general, the literature review is too old.

erosion accounts for 10% - 94% of total soil loss amount based on the collected data from published articles. Moreover, gully erosion can severely damage to infrastructure, enhance the terrain fragmentation, and cause ecosystem instability, land degradation and food safety (Poesen et al., 2003; de Vente & Poesen, 2005; Li et al., 2015; Vanmaercke et al, 2016; Hosseinalizadeh et al., 2019).

As one of the gully erosion processes, the gully headcut retreat often significantly influences

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Response: We thank you for your valuable suggestion. Indeed, the several literatures in L50-53 are old. We research and select the following literatures according to the information you provided. As a result, the sentence will be revised as "Moreover, gully erosion can severely damage to infrastructure, enhance the terrain fragmentation, and cause ecosystem instability, land degradation and food safety (Vanmaercke et al., 2016; Zhang et al., 2018; Hosseinalizadeh et al., 2019; Arabameri et al., 2020; Bogale et al., 2020; Belayneh et al., 2020; Wen et al., 2020).”. The references were listed as following:

Zhang, X., Fan, J., Liu, Q., Xiong D.: The contribution of gully erosion to total sediment production in a small watershed in Southwest China, Physical Geography, 39(3), 1-18, https://doi.org/10.1080/02723646.2017.1356114, 2018.

Arabameri, A., Chen, W., Lombardo, L., Blaschke, T., Tien Bui, D.: Hybrid computational intelligence models for improvement gully erosion assessment, Remote Sensing, 12(12), https://doi.org/10.3390/rs12010140, 140, 2020.

Bogale, A. G., Aynalem, D. W., Adem, A. A., Mekuria, W., Tilahun, S.: Spatial and temporal variability of soil loss in gully erosion in upper Blue Nile basin, Ethiopia, Applied Water Science, 10(5), 106, https://doi.org/10.1007/s13201-020-01193-4, 2020.

Belayneh, M., Yirgu, T., Tsegaye, D.: Current extent, temporal trends, and rates of gully erosion in the Gumara watershed, northwestern Ethiopia, Global Ecology and Conservation, 24, e01255, https://doi.org/10.1016/j.gecco.2020.e01255, 2020.

Wen, Y., Kasielke, T., Li, H., Zhang, B., Zepp, H.: May agricultural terraces induce gully erosion? a case study from the black soil region of northeast China. Science of The Total Environment, 750(4), 141715, https://doi.org/ 10.1016/j.scitotenv.2020.141715, 2020.

Q2. L-136 I miss here information about the land use now and the past land uses

Response: The main land use on loess-tableland position has always been farmland and orchards, while the land use on hillslope is sloping farmland and orchards before 1999, which have been changed into forested and grassy land due to the Chinese Grain for Green program. The gully channel with dams was developed for farmlands and orchard lands. These results will be added in the future revised manuscript.

Q3. L-145 I suggest to use Mg instead of t

Response: We thank you for your suggestion, and we will revise the “4350 t km^{-2} y^{-1}” as “4350 Mg km^{-2} y^{-1}” in the future Revised MS.

Q4. L-174

recurrence period of “A” type rainstorm was designed as 30 years. Previous studies indicated that the rainstorm distribution on the Loess Plateau showed a non-significant change in past decades (Li et

Response: We thank you for your careful review. We will delete the space in revised MS. The sentence will be revised as “Previous studies indicated that the rainstorm distribution on the Loess Plateau showed a non-significant change in past decades (Li et al., 2010; Sun et al., 2016; Wen et al., 2017).”

Q5. L-554 your discussion section needs an update on the literature and the topics. see here some recent papers that can help.

Li, Y., Mo, Y. Q., Are, K. S., Huang, Z., Guo, H., Tang, C., ... & Wang, X. (2021). Sugarcane planting patterns control ephemeral gully erosion and associated nutrient losses: Evidence from hillslope observation. *Agriculture, Ecosystems & Environment*, *309*, 107289.

Amare, S., Keesstra, S., van der Ploeg, M., Langendoen, E., Steenhuis, T., & Tilahun, S. (2019). Causes and controlling factors of Valley bottom Gullies. *Land*, *8*(9), 141.

Sidorchuk, A. (2020). The potential of gully erosion on the Yamal peninsula, West Siberia. *Sustainability*, *12*(1), 260.

Amare, S., Langendoen, E., Keesstra, S., Ploeg, M. V. D., Gelagay, H., Lemma, H., & van der Zee, S. E. (2021). Susceptibility to Gully Erosion: Applying Random Forest (RF) and Frequency Ratio (FR) Approaches to a Small Catchment in Ethiopia. *Water*, *13*(2), 216.

Response: We are particularly grateful to you for providing us with new literature. We will add them in the revised version. Since this manuscript was submitted in July 2020, some of the latest literature may not have been retrieved and cited. In order to make the discussion more complete, we have also searched more literatures related to this study, and will supplement them in the revised MS. Thank you again.

Q6. L-848—Figure 1-Your research is in a laboratory in the field (controlled conditions). You do not need this map or some information of the study area. I suggest to remove the frames and the 0"

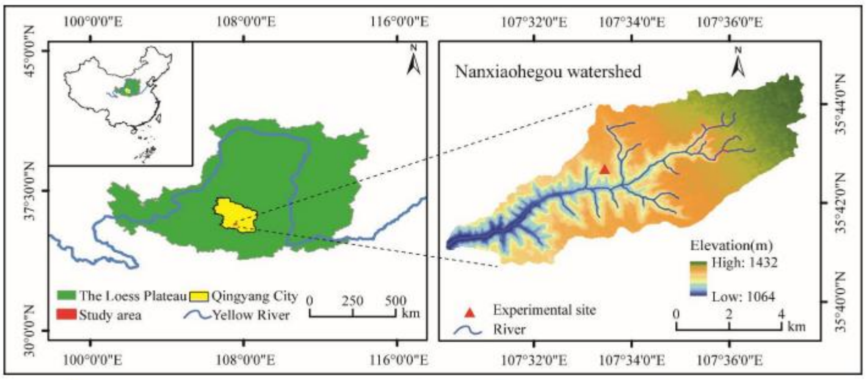


Figure 1 The location of the experimental site in Nanxiaohegou watershed, Qingyang City, Loess Plateau, China. Note: The figure production was based on the digital elevation model data (spatial resolution of 30 m) which is available from http://srtm.csi.cgiar.org (Reuter et al., 2007).

ii 2021/02/22 22:37:43

Your research is in a laboratory in the field (controlled conditions)
You do not need this map or some information of the study area

ii 2021/02/22 22:35:28

I suggest to remove the frames and the 0''

Response: We thank you for your valuable suggestion. After a careful consideration, indeed, our study is in a lab in the field under controlled conditions. The information of study area has been described in Materials and Method section. We will take your advice and will delete the Figure 1. Thank you very much.

Q7. L-863—Figure 5

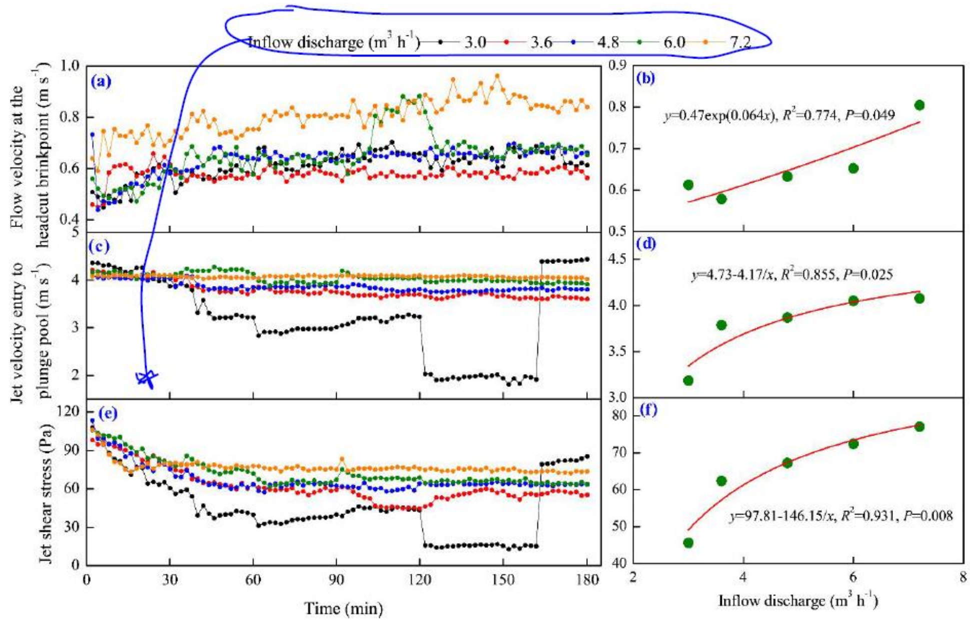


Fig.5 Temporal changes in jet properties of headcut and their relationships with inflow discharge.

Response: We thank you for your valuable suggestion. The Figure 5 will be revised as following:

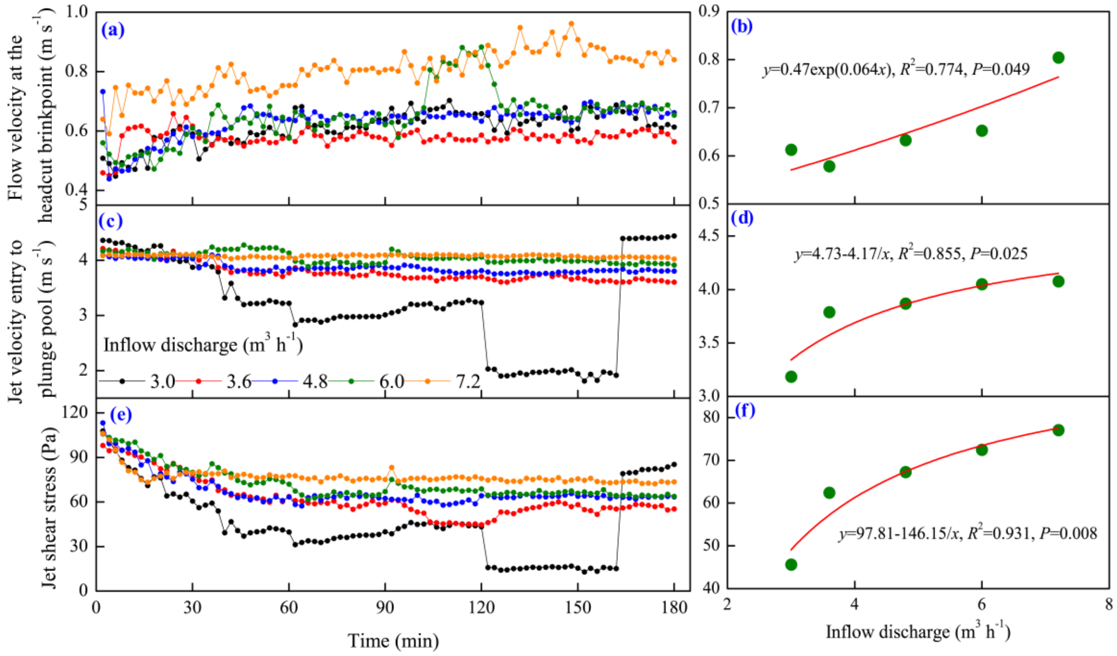


Figure 5 Temporal changes in jet properties of headcut and their relationships with inflow discharge.

Q8. L-866—FIGURE 6

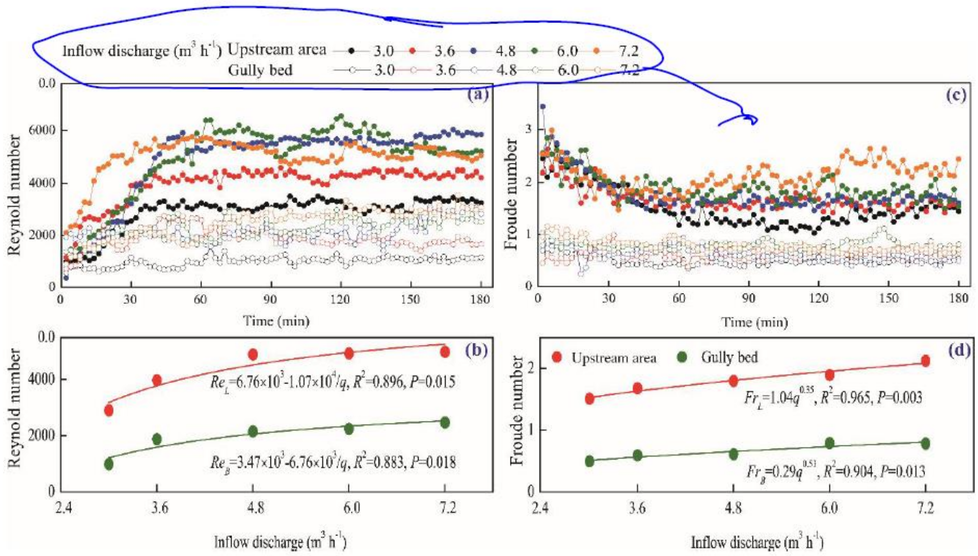


Fig.6 Temporal changes in runoff regime of upstream area and gully bed and their relationships with inflow discharge.

Response: We thank you for your valuable suggestion. The Figure 6 will be revised as following:

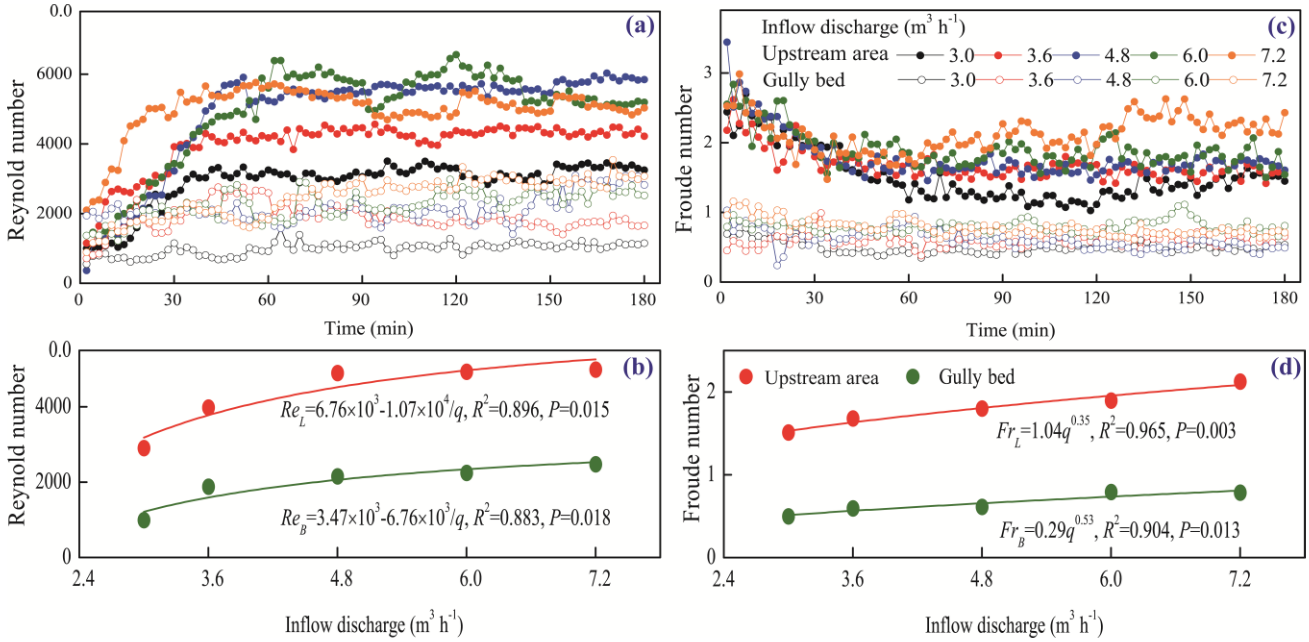


Figure 6 Temporal changes in runoff regime of upstream area and gully bed and their relationships with inflow discharge.

Q9. L-872—FIGURE 8

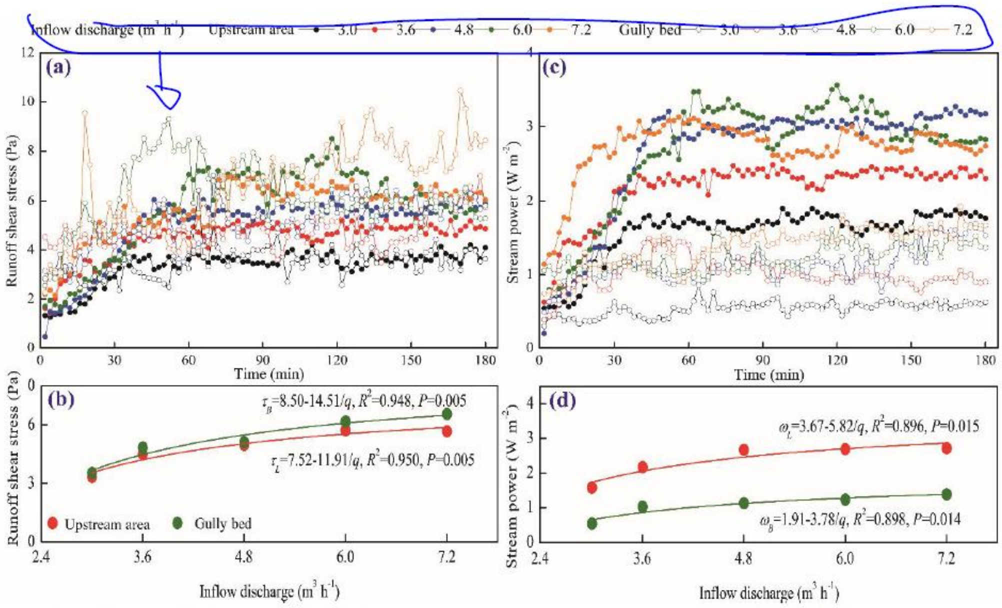
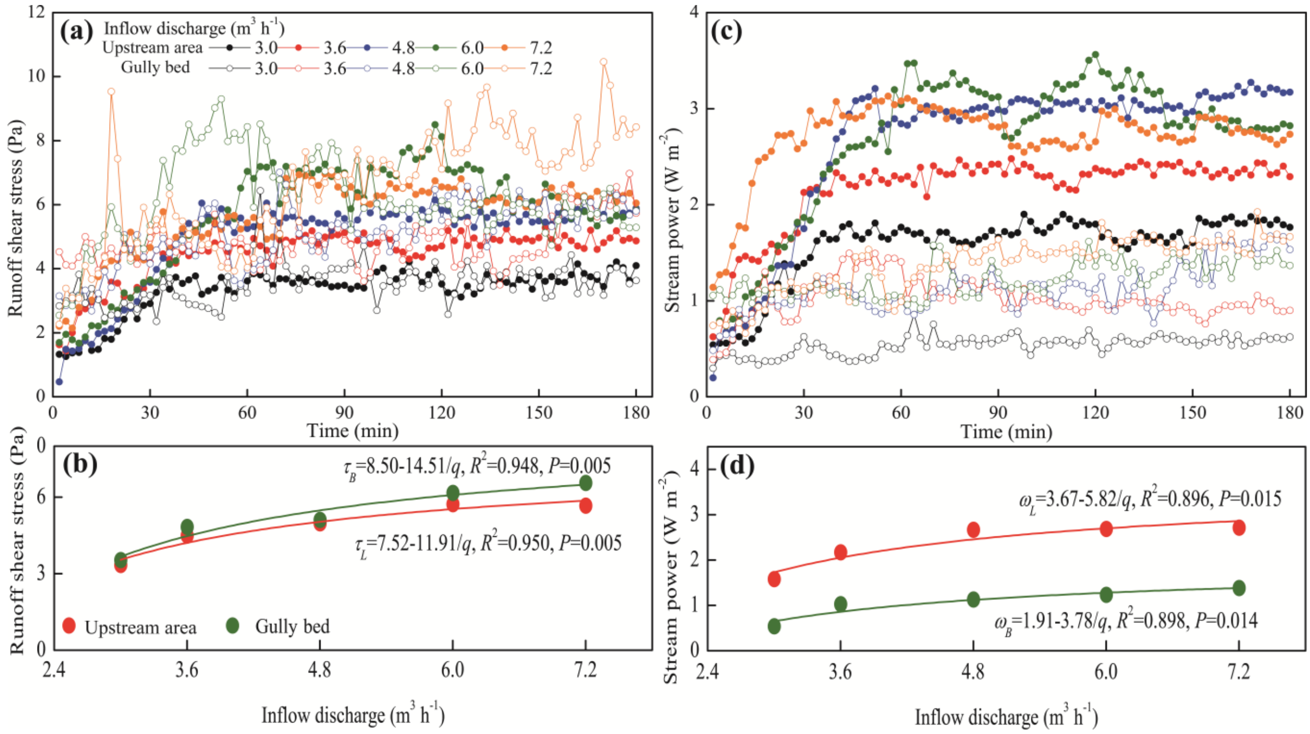


Fig.8 Temporal changes in runoff shear stress and stream power of upstream area and gully bed and their relationships with inflow discharge

Response: We thank you for your valuable suggestion. The Figure 6 will be revised as following:



Q10. **L876—Figure 9**

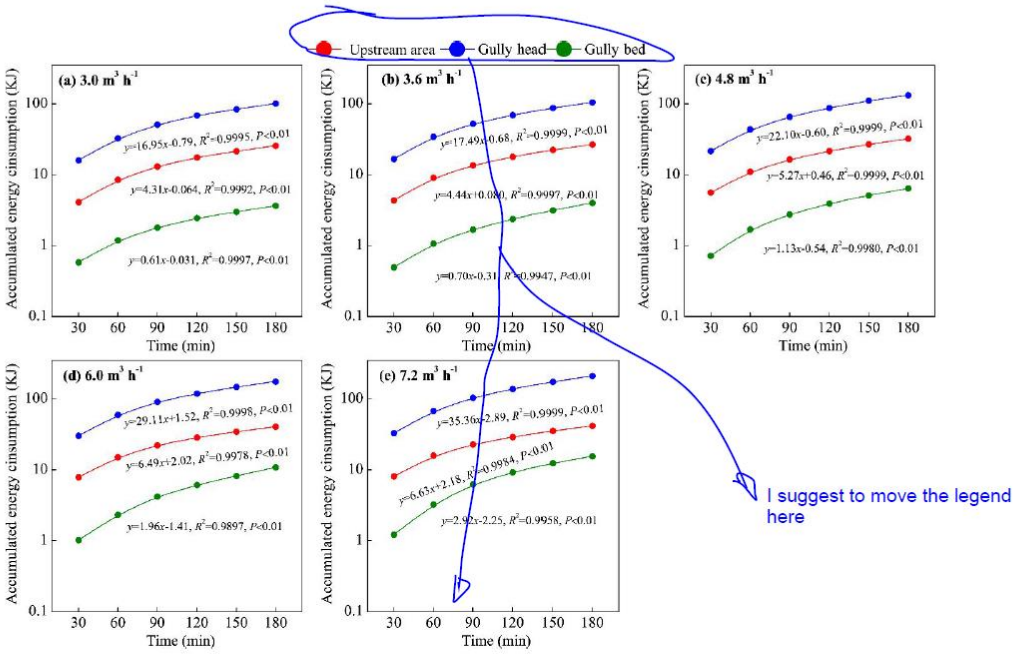


Fig.9 Temporal changes in runoff energy consumption of upstream area, gully head and gully bed under different inflow discharge conditions

Response: We thank you for your valuable suggestion. The Figure 6 will be revised as following:

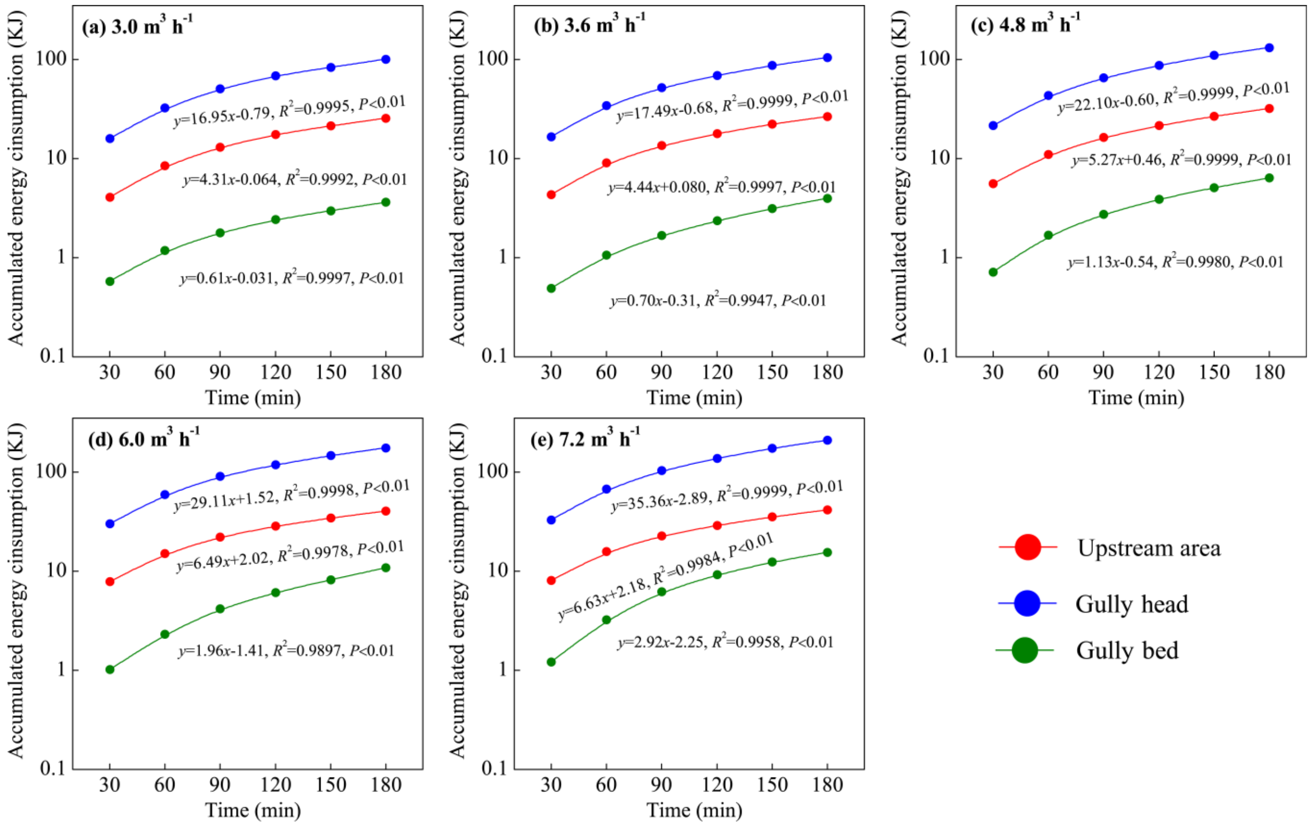


Figure 9 Temporal changes in runoff energy consumption of upstream area, gully head and gully bed under different inflow discharge conditions

Q11. L-880—Figure 10

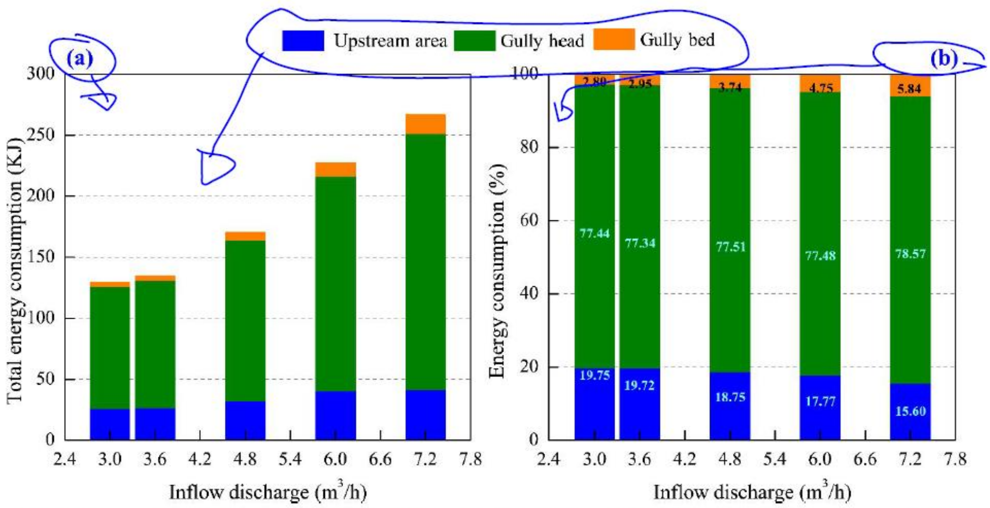


Fig.10 The variation in energy consumption of upstream area, gully head and gully bed and their proportions with inflow discharge

Response: We thank you for your valuable suggestion. The Figure 6 will be revised as following:

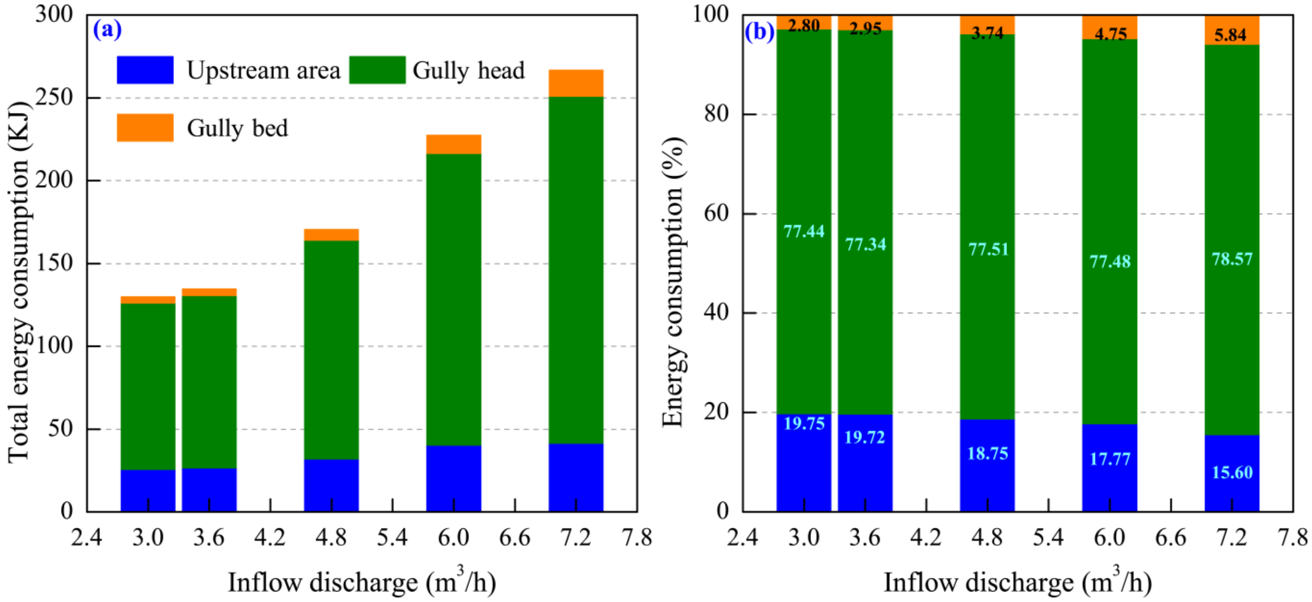


Figure10 Variation in energy consumption of upstream area, gully head and gully bed and their proportions with inflow discharge