# Developing Rating Curves for Bedrock Step-Pool Rivers using Sparse Data

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**Abstract.** The objective of this study was to investigate the possibility of a generic rating curve with a small number of adjustable parameters for the restricted class of bedrock step-pool rivers. The motivation for this study arose from Utah Valley University's long-term program of groundwater development in the Trans-Mexican Volcanic Belt, which requires hydrographs for bedrock step-pool rivers near remote mountain villages. Based upon personal communications from USGS state hydrologists and Google Earth satellite images and aerial photos, 71 USGS active or historic gaging sites were identified as bedrock step-pool rivers, involving 403 rating numbers and 13,409 gage height vs. discharge measurements. For comparison, 71 gaging sites were chosen randomly, involving 268 rating numbers and 7617 gage height vs. discharge measurements. As the distributions of gage heights and discharges were a good fit to a lognormal distribution, the data were normalized by computing the Z-scores of the logarithms of discharge and gage height, in which the average and standard deviation were computed separately for each rating number. The linear relationships between Z-scores of gage height (y-axis) and discharge (x-axis) were surprisingly similar for bedrock step-pool and random rivers. For bedrock step-pool rivers, the slope was 0.8829 with $R^2 = 0.78$, while for random rivers, the slope was 0.8467 with $R^2 = 0.72$. Numerical experiments on generating rating curves based on two random measurements for each rating number showed that 50% of all observed discharges deviated from predicted discharges by less than 31.0% for bedrock step-pool rivers and 27.3% for random rivers.

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