Traditionally, stream lines on topographic maps were used for catchment management decision making, however it is well known that these lines do not adequately represent stream extent. The modelled stream networks were still generally guided by comparisons with mapped stream line density. The availability of Digital Elevation Models (DEM) has enabled use of accumulation thresholds in estimating stream networks. Light Detection And Ranging (LiDAR) DEMs can give detailed channel networks that take advantage of accurate channel and stream head identification under forest canopy, and improve the characterisation of topographic features and hydrologic modelling. However, these can over-predict the extent of the stream network, for example, by including discontinuous gullies. While these DEM modelling techniques have been developed to map stream networks, they still do not produce representative results because they omit one of the principal process drivers, climate. This paper aims to determine where streams begin by an integrated approach using DEMs and a rainfall-runoff model. The focus is to understand how topographic features and effective rainfall impact on stream head locations. The rainfall-runoff model on which effective rainfall predictions are based is parameterised from distributed rainfall and historical streamflow data. For this purpose we are revisiting the experimental catchments along the Brindabella Range in the Australian Capital Territory. The stream head locations from ground truthing are used to define the threshold for stream initiation in each catchment. A conceptual spatio-temporal stream network delineation model is developed.