Climate change projections indicate marked changes in the patterns of runoff and streamflow experienced in south eastern Australia. The potential effects of such changes on water supply volumes has received much attention yet relatively little is known about the concomitant changes in water quality and ecological outcomes. Central to our lack of understanding is the lack of an integrated set of quantitative tools for predicting the relationship between climate change, water quality and ecological responses. To address this knowledge gap, a Bayesian Network (BN) framework is being used to link ecological and water quality responses to important features of the flow regime in Molonglo and Yass Rivers in South-eastern Australia. This paper reports on the modelling process and initial structure of the BN models. The ecological outcomes, defined in terms of the responses of fish, macroinvertebrates, algae and aquatic macrophytes, were used as the end points of the model. Expert elicitation was used to define the causal structure linking the ecological responses to water quality attributes, streamflow, land management and climate variables and the structure used to identify key water quality thresholds for ecological responses. The resulting large and complex model was simplified by using the BN model as the framework for linking a set of discrete models of different parts of the system. This allowed the team to incorporate time series rainfall-runoff modelling and water quality modelling to obtain a greater power of prediction.