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Ellen Brook catchment nutrient export: sources and pathways

BCS Rivers and Estuaries Science

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Context

Ellen Brook is a tributary to the Swan Canning Estuary and is identified as the major contributor of nutrient loads to the system. Water quality in Ellen Brook catchment and its sub-catchments is influenced by a mixture of land uses and activities affecting both surface and groundwater inputs. Previous attempts have been made to model nutrient exports from the catchment but there remain uncertainties in the groundwater and land use type contributions to the overall nutrient export to the estuary. Refinement of nutrient modeling with inclusion of groundwater-surface water interactions is essential to reduce these uncertainties. To better inform land management policy and support decision making for nutrient interventions, a distributed, 2D, processed-based hydrological and nutrient model for Ellen Brook is being developed. The model will quantify nutrient export from specific land use types, differentiate active and legacy sources and illustrate spatial and temporal variability. Climate influence will also be considered.

Aims

- Generate a hydrological and nutrient export model for the Ellen Brook catchment that will estimate the surface flux (discharge), baseflow, and regional groundwater contribution to nutrient export.
- Identify active and legacy sources contributing to stream nutrient load.
- Estimate the relationship between nutrient export and change in land use and land cover.
- Estimate the land use-specific nutrient export rate.
- Predict climate change impact and catchment management scenarios for Ellen Brook nutrient export.

Progress

- Ellen Brook mesoscale hydrological model (mHM) structure has been developed with 100m resolution of gridded morphological data including: digital elevation, slope, aspect, flow direction and accumulation, soil characteristics, geological types, land use and land cover. In addition, at 1 km resolution, data includes daily meteorological parameters of evaporation, precipitation and air temperature.
- Simulated distributed flow at 1km resolution has been calibrated using recorded daily flow at two gauging stations.
- Within the catchment, surface water quality (at 34 monitoring stations) and groundwater levels and quality at multiple locations were processed and stored in a Matlab structure datafile for subsequent use in the model.

Management implications

- Understanding the seasonal variations of nutrient concentration at each monitoring station and their relationship with flow will give an indication of whether nutrients are active or legacy types, which is critical information to assess how long it will take for water quality improvement measures in the catchment to come into effect and contribute to water quality targets.
- Development of the nutrient export model provides an opportunity to evaluate how land use change affects water quality, as well as how intervention options may assist in achieving water quality targets.

Future directions

- In-depth investigation of soils, percolation, interflow, geology parameters utilised in Ellen Brook mHM and application of field data and previous investigation to support parameter derivation.

- Groundwater levels and quality data interrogation to gain an understanding of any key water quality parameters useful as a tracer to investigate groundwater contribution to stream flow.
- Preparation of monthly data of gridded soil moisture 1 km resolution, to enable soil moisture calibration inthe model.