GOYDER INSTITUTE MODEL METADATA TEMPLATE

METADATA REQUIRED	DETAILS
Model Name and version	South East Regional Groundwater Flow Model- LEACHM Recharge Model
Date of lodgement of Metadata Template Name of Metadata Provider	August 2015 Dr Nikki Harrington nikki@innovativegroundwater.com.au
Goyder Institute Project Number and Name	**GOYDER INSTITUTE FOR WATER RESEARCH** Project No.E.2.6 South East Regional Water Balance – Phase 2 Task 1 – Regional Water Balance Model
Project Team	Project Leader: Dr Nikki Harrington Nikki.Harrington@flinders.edu.au Other Task Leaders (separate metadata sheets): Dr Russell Crosbie Russell.crosbie@csiro.au Dr Sébastien Lamontagne Sebastien.lamontagne@csiro.au
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Owner/Contact Person and contact details	Please contact: Dr John Hutson (John.Hutson@flinders.edu.au) Dr Leanne Morgan (Leanne.Morgan@flinders.edu.au) Professor Adrian Werner (Adrian.Werner@flinders.edu.au)
Model Location	The model is archives at Flinders University on the server at: V:\SOTEGoyderSEP\Data\Leachm\Program Please contact: Dr John Hutson (John.Hutson@flinders.edu.au) Dr Leanne Morgan (Leanne.Morgan@flinders.edu.au) Professor Adrian Werner (Adrian.Werner@flinders.edu.au)
IP or other permission requirements	********* **REFER TO GOYDER INSTITUTE FOR WATER RESEARCH AGREEMENT** ******* IP owned by Flinders University as per the Goyder Institute agreement, but licensed to CSIRO and DEWNR. Contact the above people to access this model
Licences associated with model and/or dependencies	********* **REFER TO GOYDER INSTITUTE FOR WATER RESEARCH AGREEMENT** ******* *Are there any licenses associated with the model and/or the dependencies that future users need to be aware of?* NO

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Confidentiality agreements associated with model and/or dependencies	*Are there any confidentiality agreements associated with the model and/or the dependencies that future users need to be aware of?* NO
Brief outline of model	The LEACHM model was used to create the recharge input files for the regional groundwater flow model developed as part of the same project. LEACHM is a one-dimensional soil water and chemical fate and transport model (Hutson, 2003). Water flow is described either by a capacity (tipping-bucket) model or by a mechanistic (Darcy-based Richard's) model. The mechanistic model was used in this work. It was used in a previous project to assess the risk of nitrogen and pesticide contamination in the Lower South East (Fleming and Hutson, 2014). The GIS-linked version of the LEACHM model (LEACHG) aims to assess regional behaviour. The stand-alone LEACHM input data file consists of sections describing the simulation period, profile geometry and boundary conditions, soil, vegetation, chemical properties, irrigation and chemical management and weather. Each of these data components vary spatially, defined by GIS rasters based on state soil and land use maps, along with spatially interpolated weather data. In addition, features such as water table depth and land surface slope class etc. may also be applied to the model in GIS format. In LEACHG, each of the data file components are selected from a library of input data files linked to raster ID values. For example, if a land use raster cell has an ID of 23, then LEACHG will read data from a library file named Crops.023. Initially, the model reads all relevant rasters, identifies unique combinations of soil, land use and weather, and performs a single simulation of each combination for the defined time period. A complete set of LEACHM output files are generated for each simulation, identified by the raster ID values that are used to name the files. Post-processing generates rasters of any desired output variable, such as drainage from the soil profile, actual evapotranspiration or irrigation applications, produces summaries of water mass balance components both in terms of water depths and volumes, and generates input data files for the groundwater model MODFLOW.
Area/region covered	The model domain includes the Lower Limestone Coast Prescribed Wells Area in the Lower South East of SA, and part of the Border Designated Area, and the encompassing groundwater flow system (Figure 1).
Platform and language and version	The LEACHM code is written in the FORTRAN language. The code is continually improved and adapted to the requirements of specific projects and post-processing requirements; contact Dr John Hutson (John.Hutson@flinders.edu.au) for a relevant version.

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Dependencies upon: i) other models and/or platforms (including version) and location ii) essential data and data sources and location	There are no dependencies on other models. The GIS platform used in this work was Idrisi, although any GIS platform could be used. All data used in the modelling is stored with the model. Weather data were obtained from SILO Data Drill interpolated data sets (Queensland Department of Science, Information Technology and Innovation). Land use data were derived from state maps using the Australian Land Use and Management (ALUM) classification system. Land use patterns predating available state data were derived from aerial photography as detailed in Harrington et al. 2015. Soil data were derived by reclassifying state soil maps into five broad textural classes.
How was model used	The LEACHM model was used to: (1) develop recharge input files for the regional groundwater flow model developed as part of the same project, (2) investigate different options for representing the recharge/discharge boundary conditions in the regional model, and (3) test the sensitivity of modelled recharge to different model parameters. A number of different model versions were developed to support the analysis of recharge, with different lower boundary conditions, model time periods, historical land use scenarios and crop parameters. These versions and their details are tabulated in Table 1. The outputs of the LEACHM Model were compared against spatial maps of recharge and evapotranspiration derived from CSIRO's MODIS-based CMRSET dataset (Guerschman et al., 2009) and various aspects of the model were refined based on this comparison. The LEACHM model developed also includes irrigation applied to crops based on imposed crop water requirements and soil moisture deficits. The modelled irrigation volumes were compared at the Groundwater Management Area scale with metered irrigation data. Despite these comparisons, the model has a number of recognised limitations, which are documented in the relevant reports listed below. The time period of the LEACHM model simulations can be extended, however this requires modifying the input data files and obtaining or generating the required climate and land use datasets.
Specificity of data	Most of the data used (climate, soils) are publically available. Land use maps used were either obtained from DEWNR or (in the case of 1969 and intermediate (1983) land use maps) generated as part of the project. All datasets used in the model development are stored with the model.
Datasets/data products produced	All datasets produced are stored with the model as above.
Other Information	

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Publications (papers and technical reports)	Harrington, N, Millington, A, Sodahlan, ME and Phillips, D, 2015, *Development of Preliminary 1969 and 1983 Land Use Maps for the South East of SA*. Goyder Institute for Water Research Technical Report 15/16. Hutson J (2003) LEACHM (Leaching Estimation and Chemistry Model): A process-based model of water and solute movement, transformations, plant uptake and chemical reactions in the unsaturated zone. Version 4. Department of Crop and Soil Sciences, Cornell University, Ithaca, New York. Fleming N and Hutson J (2014) Primary production to mitigate water quality threats. Final report for Project 54116. South Australian Research and Development Institute, Primary Industries and Regions SA. Morgan, L, Harrington, N, Werner, A, Hutson, J, Woods, J and Knowling, M, 2015, *South East Regional Water Balance Project – Phase 2. Development of a Regional Groundwater Flow Model.* Goyder Institute for Water Research Technical Report 15/38. All Goyder Institute Technical Reports are available from http://goyderinstitute.org/index.php?id=1
Collaborations and acknowledgements	Russell Crosbie (CSIRO) provided the MODIS CMRSET dataset and spatial estimates of recharge based on this for comparison with the LEACHM model.
Keywords	LEACHM South East Recharge modelling Water balance

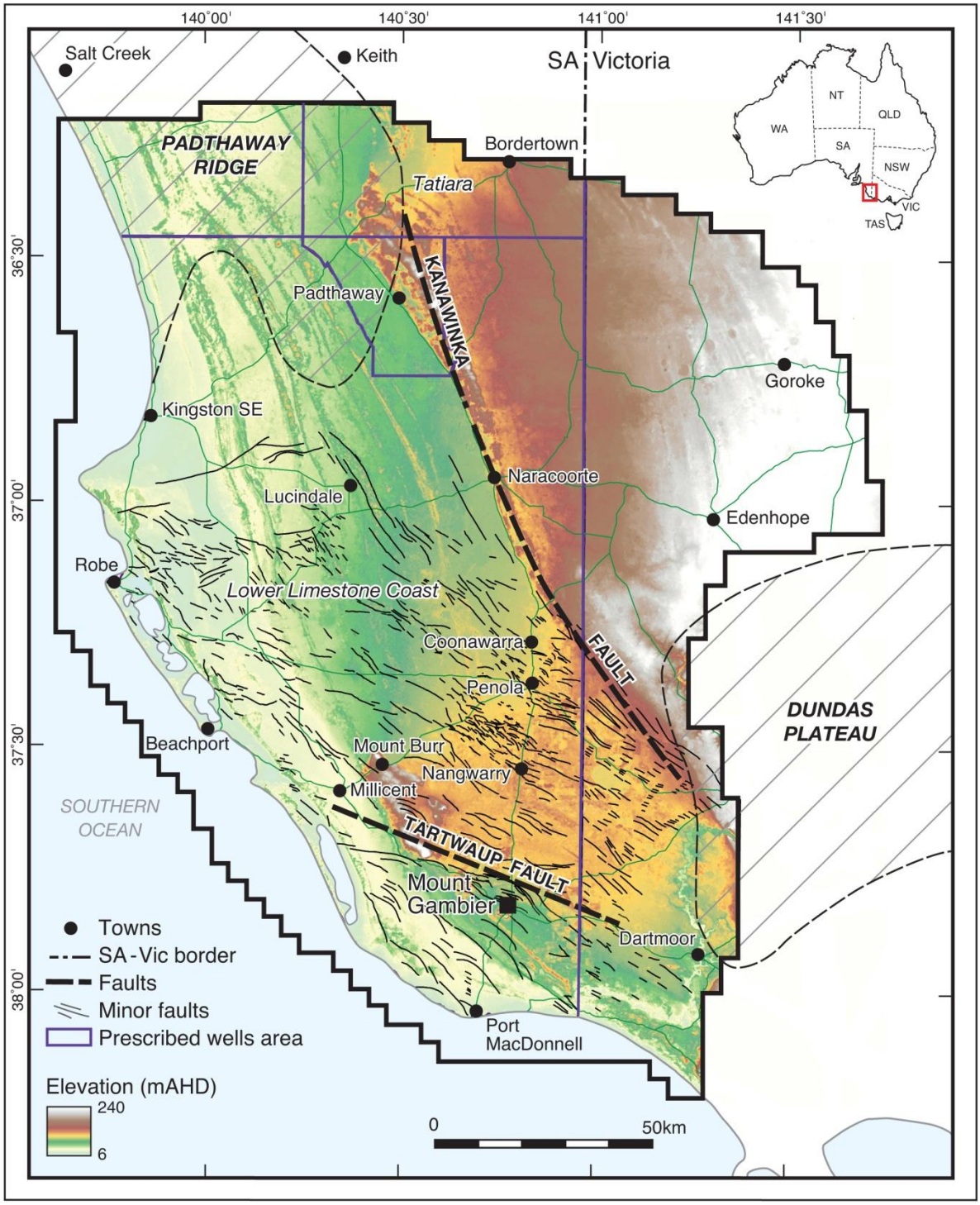

Figure 1. Model domain